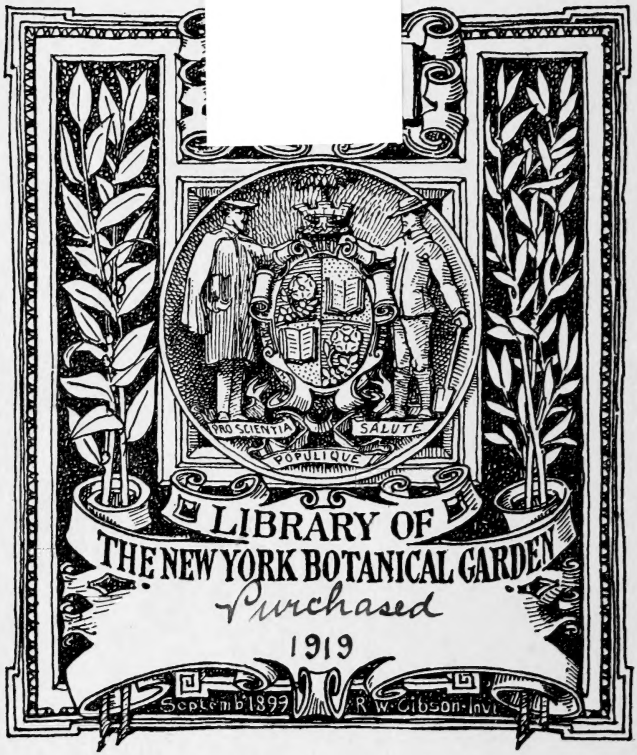
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BRANCH OF FRUIT OF MEECH'S PROLIFIC QUINCE, FROM A FIVE YEAR-OLD TREE.

QUINCE CULTURE

AN ILLUSTRATED HAND-BOOK FOR THE PROPAGATION AND CULTIVATION OF THE QUINCE, WITH DESCRIPTIONS OF ITS VARIETIES, INSECT ENEMIES, DISEASES AND THEIR REMEDIES

BY

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REVISED AND ENLARGED EDITION.

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ILLUSTRATIONS.

PREFACE.

To cultivate any fruit with the highest success there must be sufficient knowledge of what is involved to enable the cultivator to assign a reason for what he does both to the soil and to the tree.

The object of this work is to furnish a manual or hand-book for the novice and those who are already more or less informed, and yet desire a work of reference to consult in the various operations necessary to attain the highest success in quince culture.

Aware of the imperfections of everything human, the author does not expect that this attempt to furnish a collective exhibit of the points of greatest interest pertaining to this culture of a much-neglected fruit will be beyond criticism. The demand for a work on quince culture is urgent, and is shown by many letters of inquiry from all parts of the country. Solicitations have been numerous, asking the author to write this book, and give the world the results of his experience.

On consulting the large libraries of the great cities, and those in smaller cities and towns, no separate work was found on quince culture. Interesting articles are scattered through many volumes on agriculture, horticulture, and gardening, showing marked improvement in the culture of nearly all fruits. There are works more or less pretentious on the culture of the apple, pear, peach, etc., but the various articles relating to the quince are dispersed through so many different books, that the labor of finding them, when the information they contain is wanted, is too great to be generally undertaken by even those having access to ample libraries.

After deciding to prepare this manual, the author spent a year re-examining all the points, as the seasons favored,

to be well satisfied in regard to all the insect enemies and diseases of the quince, and in reading whatever he could find upon any part of the subject. Besides the many points of interest in his own experience and observation, he takes great pleasure in acknowledging his indebtedness to the writings of Charles Downing, John Lindley, J. J. Thomas, A. S. Fuller, S. W. Cole, W. Sanders, P. B. Mead, and others in the department of propagation and culture. In studying the insect enemies of the quince, his own observations have been greatly aided by the works of Harris, Packard, Riley and Saunders, on entomology. In observing the diseases to which the quince is subject, substantial help has been derived from Professor Arthur's researches on the blight, and the North American Fungi of Professor Ellis. In the hope that it may prove a serviceable help to all who shall consult its pages, it is respectfully submitted to the public by the author.

PREFACE TO SECOND EDITION.

Since the publication of the first edition of this work a number of insect enemies have been investigated, and several species not then suspected have proved injurious to the quince. All these, as well as the important fungous diseases to which the quince is subject, are described in this volume, together with their preventives and remedies. Of special interest will be found the chapter on the analysis of the quince, by Dr. H. W. Wiley. Condensed descriptions of the varieties of recent introduction have also been added, thus bringing the work up to the present date.

W. W. MEECH.

INTRODUCTION.

We live in a progressive age, when knowledge is greatly increased, and the mental horizon widened by the researches and observations of experimenters in horticulture, as in every other pursuit. Improvement in quince culture has been remarkably slow, yet, on the whole, has certainly attained to an encouraging state of progress. The markets of the country are beginning to be fairly supplied with this fruit, where but a few years ago it was very scarce.

For both ornament and profit I know of no fruit that can be planted with better promise of success than the quince. In a city yard, or a village garden, there will be some spot for a tree or two; and on a farm, large or small, the judicious planting of this fruit will be a most profitable investment. The method of culture here described has been attended with marked success. In practice, the difference between success and failure often depends on a little thing, very easily overlooked by the most skilful. But as a good general organizes a victory out of a defeat, so will a good culturist learn by his failures to succeed in further trials, as by them he gets back to first principles.

Quince culture is both an art and a science. One great reason why the cultivation of the quince has been so much neglected is, that it was accepted as a foregone conclusion that no success was to be expected in the place and with the facilities at command. But now, with the multiplication, improvement, and cultivation well understood, and reduced to some degree of exactness, it is as reasonable to expect success with this as with any other fruit.

It will be of great service to understand the principal laws governing the growth of plants, and the application of those laws to this fruit. The method of culture most in agreement with these laws will always give the greatest promise of success. As was said at a meeting of the Maryland Horticultural Society: "This fruit deserves systematic cultivation, instead of the careless system of a tree here and there in the corners of fences, and in wet places, untrimmed and choked by weeds."

In 1872 the editor of the "Horticulturist" asked: "Why does not some one, of a careful turn of mind, forsaking the beaten path of fever for strawberries, cranberries, pears, and peaches, study the characteristics of the quince, and learn its needs of soil and climate, and then follow them up by planting a good orchard?" The author has done this, and here gives the results of his experience.

The aim in this manual is to furnish all needed information for the profitable cultivation of quinces in all places where they will grow. Let this fruit, for which there is no substitute, be no longer only a luxury within the means of the rich, but become so common and abundant that it may be enjoyed by all. It will greatly increase the true wealth of the nation to provide all classes with all the varieties of fruits in their seasons, and so extend the means of health and happiness.

QUINCE CULTURE.

CHAPTER I.

HISTORY OF THE QUINCE.

CYDONIA, to which the Quince (*C. vulgaris*) belongs, is a genus of trees and shrubs of the natural order *Rosaceæ*, sub-order *Pomeæ*, and nearly allied to *Pyrus*, with which some botanists unite it; but it is distinguished from Pyrus by having many seeds in each cell, and by the abundance of mucilage in the seed cells. It is found all through Western Asia and Southern Europe, whence its cultivation has been extended.

The rabbinical traditions of the Jews make it the most ancient of all our fruits, dating back to the Garden of Eden; and there, by its exquisite beauty and delightful fragrance, tempting Eve to commit her first disobedience. In harmony with this tradition, is the fact that the quince grows in high perfection all through Palestine and the surrounding countries. This fruit at Hebron is so mild that many eat it out of hand, as we do apples and pears. Both Jews and Mohammedans make great use of it for various confections, preserving it in earthen vessels akin to the crocks in use among us. According to the "Horticulturist" for 1848–9, "The quince of Persia attains a weight of fifty to sixty ounces; ripens on the tree or in the store, and can be eaten like a soft ripe pear."

It was early cultivated among the Greeks, who called it the *Kudonion Malon*, the *Cydonian Apple*, and used

it extensively as a preserve. Its botanical name, *Cydonia*, comes from *Cydon*, a city on the island of Crete, where it grew abundantly. They found it then, as now, "both toothsome and wholesome." A writer in the seventh volume of Putnam's Magazine tells how the ancients testified to their appreciation of this fruit by dedicating it to Venus. They regarded it as the emblem of both love and happiness. With it they decorated the temples of Cyprus and Paphos. It was the chosen ornament of the statues of Hymen. In the garden of the Tuilleries there is a figure of Hercules holding quinces in his hand. According to Plutarch, Solon enacted a law that this fruit should be the invariable feast of each newly-wedded pair before they retired to their nuptial couch. Homer, the Asiatic Greek and father of epic poetry, three thousand years ago described a garden in his Odyssey with such classic beauty, and sympathy with the real life of the people of that age, that we almost wish we had lived in his Smyrnian home to regale ourselves with the luscious quinces and other fruits there grown in their perfection.

From the classic plains of Greece, where it may have formed the sacred shade of Academus, this golden fruit, in genial fellowship with literature and the arts, traveled into Italy, where Virgil, the prince of Latin poets, threw over its own inherent charms the rhythmic spell of his enchanting lays. One of the magic effusions of his genius appears in the beautiful lament of the shepherd Damon, in the VIIIth Eclogue, where he honors the quince by placing it among the select exponents of a higher order of nature, hypothetically conceived to illustrate the irremediable determination of the lover's despair.

The quince was, according to Goropius, the golden apple of the Hesperides. Columella, the most elegant and extensive agricultural and horticultural writer of his time, "who scattered incense upon the altar of its virtues," extolled it as the promoter of both health and pleasure.

The Elder Pliny, with the fond instinct of the true pomologist, eloquently descants upon its valuable properties, and paints the tree as it appeared about Rome, with its branches depending to the ground, jeweled with starry fruit. In fact, "the clever criticisms of this early naturalist soon became lost amid his enchanting panegyrics." Different varieties of the quince (more than we possess now), he tells us, were cultivated in profusion throughout Italy, "both for ornamental and useful intents." Like the orange and lemon in our Northern States, it appears sometimes to have been grown in boxes, which "were exposed for admiration in the ante-chambers of the great." He extolled most highly its health-imparting and medicinal virtues, enlivening his classic descriptions with a warmth of enthusiasm which "must inevitably fill the modern admirer of the quince with enduring delight."

Professor Targioni, an Italian horticulturist, informs us, that at the present time the peasantry in some parts of Southern Europe highly prize the quince for perfuming their stores of linen, and that in the yet warmer lands it is still found as gratifying to the palate as to the nostrils. A recent traveler in Persia, after speaking of its use as a dessert, says it is yearly forwarded as presents to Bagdad, where the highly perfumed odor is found so powerful, that if there be but a single quince in a caravan, no one who accompanies it can remain unconscious of its presence.

The Italian name of the quince, *cotona* or *cotogna*, is believed to be the origin of *melocoton* for a quince, as *melocotogno* is the Italian for a quince tree. The Spanish *melocoton* is a peach tree grafted on the quince, or the fruit of this, but *membrillo* is the Spanish name of the quince, as *malum cotoneum* is the Latin for a quince-apple. The Portuguese name is *marmelo*, from which comes our marmalade, a most valuable form of pre-

serving the Portugal quince, one of the best quality. In the south of France, on the border of Garonne, quinces are extensively raised to make marmalade, which is called *cotignac*, from the Italian. The French name of the quince is *coing* or *coignasier*, a corner, and seems to have been applied from the old idea of planting this tree in a fence corner. The Dutch call the quince *Kivepeer*, and the Germans *Quitte* or *Quittenbaum*, and both cultivate it quite extensively. From Royle's Illustrations of the Himalaya Mountains we learn that "The quince plants introduced from Cashmere do not differ from those already in India (*Cydonia vulgaris*). It is found, either in a wild or cultivated state, on the ramifications of Taurus and Caucasus, Hindoo-Khoosh and the Himalayas, or in the valleys included within them." "They are abundant at Bokhara and other places in the north of Hindoo-Khoosh."

It is now found growing spontaneously on the banks of the Danube and in Southern France. It is also extensively cultivated in various parts of the French Republic, especially at Angers, whence the stocks of young trees are sent abroad by the million. Early in the history of England we find accounts of its culture, where it was employed for hedges as well as for ornament and fruit. It seems to have traveled with the march of civilization, and been celebrated in song as in mythology.

The Pilgrims early brought it to New England, where it was cultivated on the rugged hillsides and in the valleys; and as they spread over the country in their migrations, they carried with them the older varieties of this fruit. The chief improvements in the varieties and modes of cultivation are the result of the last half century's experience; and now, as we see all parts of the civilized world interested in this fruit, we hail with joy its progress and success.

CHAPTER II.

STRUCTURE OF THE QUINCE TREE.

THE *root* and *top* are the two principal parts of all trees. When raised from seed, a plant or tree has first of all a main or *tap-root*, which goes down into the ground, where it ramifies, and gives support and nourishment to the top. The point where the root and top meet is the *collar* of the tree. Trees grown from cuttings do not have a tap-root like seedlings, but make up for it by the large number of *laterals* which they send out. The *top*, consisting of the *trunk* and *branches*, terminating in twigs with their leaves, is the counterpart to the root system. The quince, in these respects, differs in no way from other trees. The bark of one year old twigs and shoots is beautifully flecked with a thick dotting of light-colored spots, called *lenticelles*. They are corky formations, having just projection enough to give a slight roughness to the surface.

The *buds* are of two sorts, leaf and fruit. The buds of the quince that produce fruit push out short growths from one to three inches long, on the ends of which are the *blossoms* and *fruit*. The leaf buds resemble them at first, but when expanded are destitute of the organs of the flowers and fruit. The quince makes its most vigorous buds on the sides of its shoots instead of the ends, and, when well cultivated, growth continues until the autumn frosts nip the terminal buds. A large number of the buds are *latent*, and may remain dormant for years. They are Nature's reserve to grow when others are destroyed. When a vigorous shoot has been well cut back, buds often push on each side of the visible buds, giving three and sometimes more growths at one place. The latent buds are developed when large branches are

cut back or broken off by accident, or when even the whole head of the tree has been removed. In a very vigorous tree it is quite common to have the buds push their threefold development simultaneously; the central growth bearing the blossom, and those on either side of it only making wood-growth. Occasionally two of the three bloom together. By observing the position of the buds along a branch, in going the length of five buds you can so prune as to give any desired direction to the new growth, and thus form a symmetrical tree.

The *leaves*, with their *stipules*, form the foliage of the tree, and seem to serve much the same purpose for it that the lungs of animals do for them. Leaves not only give beauty to the tree, but are necessary to its existence. They are formed of a series of veins, between which is the *cellular tissue* or *parenchyma*, which consists of numerous *cells* of various forms, with *air spaces* between to increase the surface exposed to the air and sunlight. There are about 25,000 of these breathing pores in each leaf, through which moisture and air are received, and vapor and carbonic acid given off. By this process the sap in the leaves is thickened, and the material of woody fiber elaborated. The *wood* of trees is chiefly carbon, which the leaves have absorbed from the air. Their nitrogen comes from the combined influence of the air, the sun's light and heat, the humus of the soil, and the action of potash. Analysis of the ashes shows that a very small part of the constituents come from the soil. The air is an abundant storehouse of exhaustless capacity, full of the materials of plant growth, to which each cultivator possesses a key. Every man and air-breathing animal on earth is helping to keep this atmospheric storehouse filled with the material of plant growth by every breath exhaled; and so all animated creation is at work for the tiller of the soil. Not only are the leaves the laboratory of the growing wood, but

also of the fruit. If we would have perfect fruit, we must have plenty of good healthy leaves to mature it. If diseases or insect enemies are allowed to deprive a tree of its leaves, the growth both of wood and fruit will suffer accordingly.

The *flower* of the quince consists of a five-parted calyx, urn-shaped, of a green color; a corolla of five pinkish colored petals, quite broad at the outer end, and five styles in the midst of many stamens that fructify the seeds. In exceptional cases there are six petals, and occasionally a semi-double blossom with ten. The *seeds* are in five large cells, in each of which are two rows of seeds, covered with a thick mucilage. The quince flowers in May, and sometimes a few flowers appear in June. In exceptional seasons the quince, like other trees, will bloom in autumn. I had a young tree bloom full in the fall, that put out quite feebly the next spring, and died entirely the second year after.

The *fruit* is either apple or pear shaped, and covered with a white down, that affords partial protection from insect enemies. If the quince is gathered before it is fully ripe it is very slow in coloring, and may never wear the rich golden yellow it would if left to mature as Nature intended. Though one of the hardest of all fruits, it is also one of the easiest bruised, and then most rapidly decays. Early ripening varieties are not as high flavored as the later, and much sooner decay.

The life force or vital principle acts on the carbon, oxygen, hydrogen, nitrogen, and mineral matters which are combined in the formation of the cellular structure of the tree in all its parts. The mystery of plant life is, that the germ in the seed has in it the organizing power that determines both the form and functions of the cells by which it builds up all its growth. Chemical analysis reveals the various elements and their proportions in the vegetable cell; but the utmost skill of the chemist, with

all his knowledge of matter, has never enabled him to so combine these elements as to produce and build up living organic matter from what comes to him without life.

CHAPTER III.

VARIETIES OF THE QUINCE.

THERE is a difference of opinion among horticulturists as to what constitutes a variety. Some classify all the varieties as being either apple or pear quinces, without regard to the other differences. Others class as varieties all that show distinctive differences in their habits of growth, time of ripening their fruit, shape, and qualities of color, fragrance, and flavor. To the latter class the writer allies himself, and will be governed in his descriptions accordingly.

Traveling over this country from east to west or from north to south, we find a great number of seedling varieties that have no distinctive names, but are called by their possessors after the well-known varieties from which they are supposed to have sprung, or which they most closely resemble. On this point Charles A. Green, of the "Fruit Grower," has well said: "Almost everything in the shape of a quince that is not known to be Angers or Champion is called Orange quince. The race of Orange quinces has sprung from numerous seedlings, and there are numerous types of it all over the country that vary in shape, size, quality, and dates of ripening. I have given this matter the closest attention, and find in my travels that the Orange quince is divided into many strains coming from different sources. Quinces have sprung up in gardens, have been planted, propagated, and called Orange quince, for the reason that they

resembled that quince more closely than any other variety. In many cases these are not Orange quinces, but seedlings that vary considerably. I do not doubt but that Meech's Quince is one of these variations of the Orange quince, of an improved type."

In harmony with this view of Mr. Green, I first called this variety the Pear-shaped Orange Quince, and only consented to change it to Meech's Prolific when my horticultural friends showed that it needed a different name to avoid being confounded with some of the other pear-shaped varieties. I have seen samples of half a dozen seedlings grown in Pennsylvania and New Jersey, each of which was clearly distinct in tree or fruit, or both. A seedling tree in Philadelphia bears a very pretty quince having the marks of the old Orange quince. At Jenkintown, Pennsylvania, is a seedling tree growing more *upright* than its parent, but the fruit very closely resembles it. In Bridgeton, New Jersey, is a seedling that produces a beautiful specimen of the obscure pyriform of mild acid quality. In Millville, New Jersey, is a seedling shaped like an apple, except that it is very deeply ribbed from the blossom to the stem all around. In Vineland there are two good seedlings of the apple and pear shapes, and each of them an improvement on its ancestry. So, no doubt, close observers will find it all over the country. The fruit books and catalogues offer but a very short list of varieties. I here give, in alphabetical order, the varieties of most importance, as now found in cultivation, with a few not very commonly found.

1. Anger's Quince (*Cydonia vulgaris*).—This variety has a remarkably strong and vigorous root system, which has made it valuable as a stock for dwarfing the pear. The nurserymen of this country import large quantities of these stocks every year for this purpose; and for the Champion quince, which succeeds better on them than on its own roots.

In my experience the Angers has been very uncertain. Sometimes it is entirely barren, and then, again, bears abundantly. The fruit varies from the shape of the apple to the pear, having generally a modified form

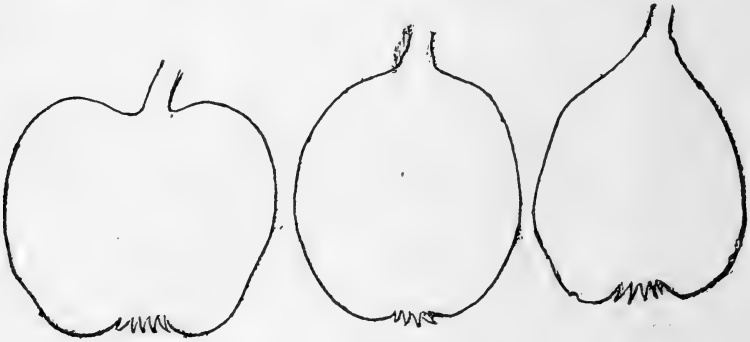


Fig. 1. Fig. 2. Fig. 3.

ANGERS—THREE FORMS.

between them. Sometimes it attains to a weight of twenty ounces. The fruit ripens quite late in the fall, and will keep well in a common cellar, like apples. The flesh is a little coarser than that of the Orange.

2. Apple or Orange Quince (*Cydonia vulgaris* v. *maliformis*). This is generally known simply as the Orange quince. Some speak of the Apple quince as distinct from the Orange; but, as generally understood, they are one and the same variety. One old author speaks of the Orange and Angers as one and the same; but he could hardly make a clearer mistake. The Orange variety is most cultivated in New York and New England, probably because of its early ripening.

The *old* Orange quince tree is very readily distinguished by the trunk and larger limbs having very rough excrescences all around them at very short intervals. The color of the leaves and of the bark on young twigs is perceptibly lighter than on the other varieties, includ-

ing seedlings. The strains of the Orange quince that have evidently sprung from its seeds, will generally be found to have smoother trunks, with deeper color of leaves and of the bark on the twigs. The shape of the fruit in the *old* Orange quince is like a Rhode Island Greening apple or a Fallawater. It is often broadened toward the stem, and occasionally shapes up to the stem like a Seckel pear. In some of the *newer* strains the whole body of the fruit is more elongated. The color is a rich orange, which is often marred by red spots as the fruit matures; and when fully ripe

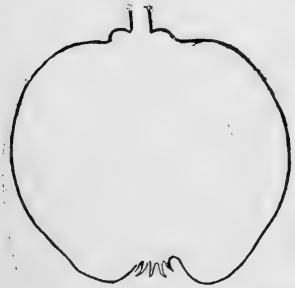


Fig. 4.—ORANGE, OLD TYPE.

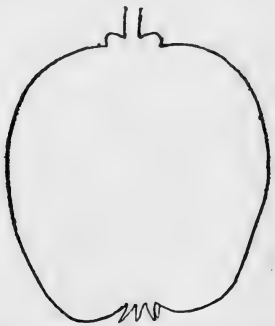


Fig. 5.—ORANGE, SEEDLING.

these spots sink below the surface, and after a little while become centers of decay. This decay is frequently seen while the fruit is yet on the tree. The flesh is generally tender, and the flavor good, though not as high as in varieties that ripen later. This lack of high flavor is much more noticeable in New Jersey and further South, where it ripens about the middle of September, when the weather is hot, than in New York and further North, where it ripens later, and cooler weather brings the fruit to a higher perfection.

The time of ripening in all places will vary with the variations of the season. Trees in very full bearing will

take longer to perfect the fruit. I have seen a difference of two weeks, which was clearly attributable to this cause. A fair weight for the Orange quince is about half a pound; but in favorable circumstances it will come up to a pound, and has reached twenty-two ounces. In many parts of the United States it has long been the most popular variety, though some of the seedlings which bear this name are inferior.

3. The Champion Quince.—This variety is one of those but lately brought to public notice. It is described

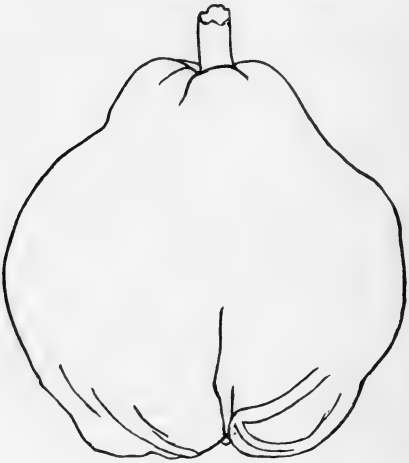


Fig. 6.—CHAMPION.

Fig. 7.—CHINESE.

as being "obscure pyriform, between the shape of an apple and a pear, with the stem inserted at the base of an unusually prominent lip, and inclined; the skin a lively yellow, strongly russeted for a short distance around the stem; calyx set in a remarkably deep and strongly corrugated basin." The tree is very vigorous, and comes early into bearing. The fruit is larger than the Orange. It ripens later than any other quince, and has been grown to weigh twenty-four ounces.

It is especially difficult to propagate from its own cuttings. The growing shoots have a very dark color, which is peculiarly its own, and distinguishes it from others. It is unusually subject to blight in some parts of the country. In some sections it grows vigorously and bears abundantly, while in others it is a very moderate grower, and bears accordingly.

4. CHINESE QUINCE (*Cydonia Sinensis*) is a variety cultivated for ornament. In the Southern States it is in favor for its fruit, which sometimes attains a weight of two and a half pounds. I have found the quality good for a preserve, though the grain is a little coarse. The tree grows to the hight of thirty feet or more. The foliage assumes a beautiful red tint in autumn. The flowers are rosy red, with a violet odor. It blooms in May. The fruit is very large, smooth, oblong-oval, and of a greenish yellow. The flesh is firm; and when preserved turns to a beautiful pink. It ripens late, and keeps a long time in sound condition.

This quince was taken to Holland at the close of the last century, and to France in the beginning of this, and fruited in the Jardin du Roi in 1811. It proved hardy in Paris, but the season was short for its fruit to ripen well. It succeeds in the West Indies, and in the United States south of Maryland. To swell some catalogues the Chinese quince trees have been called Hong Kong and Lutea.

5. DE BOURGEAUT is a late French sort, described as "Feathered trees," and in appearance looks quite different from any other variety.

6. FONTENAY or NEW UPRIGHT.—This derives its name from its upright form. It is slender and branching, and forms small, compact trees. The bark is very light green. Its cuttings root very readily. It is used for stocks.

7. FULLER QUINCE.—This new variety was discovered about twenty years ago by A. S. Fuller, at Ridgewood,

Bergen County, N. J., on the grounds of a neighbor, from whom he obtained cuttings and propagated a few trees. The original tree was broken down and com.

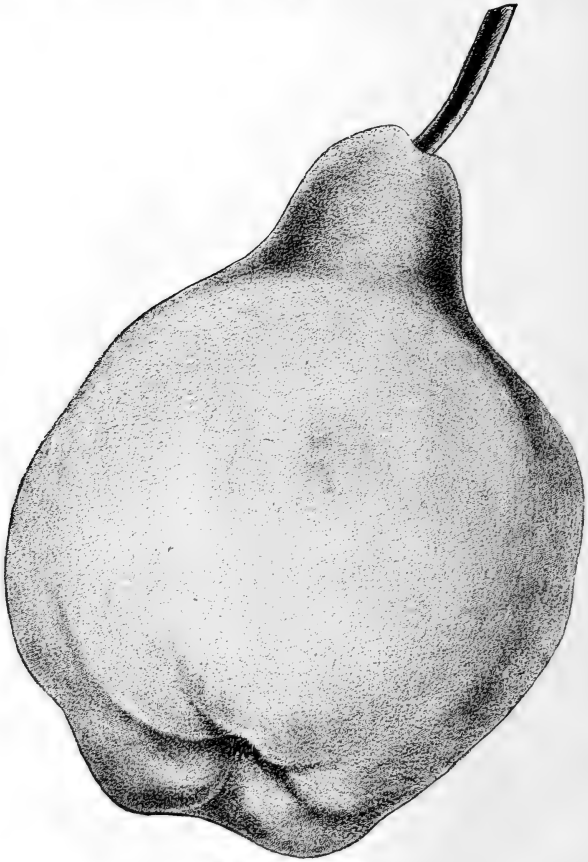


Fig. 8.—FULLER.

pletely destroyed by the workmen while building a new house, and but for the timely notice of Mr. Fuller would have been lost to the world. The beauty of the fruit,

when it assumed a rich golden yellow early in the season, was what first arrested Mr. Fuller's attention. "It is large and uniformly pear-shaped, occasionally with a long slender neck, not larger than a man's thumb. Flesh fine-grained, with very little of the usual grittiness common to the quince." Dr. Thurber adds to these points of Mr. Fuller's description, that the surface is somewhat ridged, that the calyx is set in a deep, wide basin, and that the flesh is remarkably tender and well-flavored. The specimen figured weighed nineteen ounces.

8. The Japanese Quince (*Cydonia Japonica*) is the well-known flowering quince of our gardens, and is conspicuous in early spring for its brilliant flowers. It is a thorny, straggling, and bushy plant, sending up numerous suckers, which admirably adapt it for forming hedges, for which purpose it is often used. The fruit is generally elliptical, but often resembles a peach. The color is greenish yellow, often with blushing cheeks. The flesh is very hard and firm, but strongly aromatic. The jelly made from it is excellent. It will flavor two or three times its own bulk of other fruits. The scarlet flowers of the Japonica, as they open among the first blossoms of spring, are unsurpassed in their brilliancy and the charm they impart.

9. Meech's Prolific Quince.—This variety is the most uniformly prolific of all known varieties. So far as I have been able to trace its history, it originated in Connecticut over thirty years ago, and was slightly distributed under the name of the Orange quince, or without any specific name. Some trees were taken to New York, Ohio, and New Jersey, but no general attention was attracted to its merits until the stock came into the hands of the author, who, after testing it beside other sorts, published in 1883 an article in the *American Agriculturist*, describing it under the name of the Pear-shaped Orange Quince. The article attracted the atten-

tion of the venerable Charles Downing, who wrote that he judged, from the description, it was a new variety, in which opinion he was fully confirmed by a subsequent examination of the fruit. He expressed his belief not only that it was "an acquisition to the quince

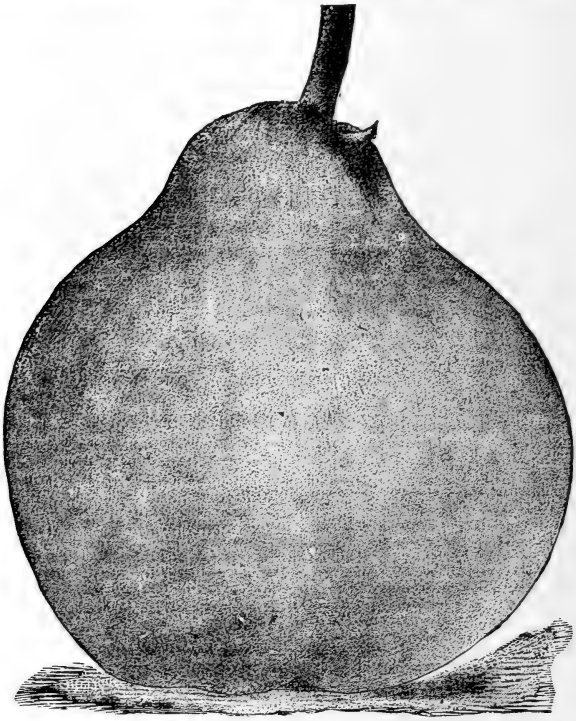


Fig. 9.—MEECH'S PROLIFIC.

family," but "worthy of general cultivation." So far as tested, it has justified his good opinion.

The trees of this variety are exceedingly vigorous, fully equaling, if not exceeding, the Angers. The trunk is smooth, and entirely free from the excrescences of some other kinds. The bark of the young twigs is darker than

that of the Orange, and is beautifully flecked with lenticelles. The leaves are very broad in proportion to their length, and of a deep shade of green. The blossoms are very large. The buds have been substituted for those of the rose in floral designs with happy effect. It is not uncommon for one year old trees to blossom in the nursery rows, and occasionally bear fruit to ripeness. Such trees, after being transplanted, have uniformly borne every year after, so that I could show the horticultural wonder of fruit on every age from one to twelve years.

The fruit is obscure pyriform, very large, of a bright golden yellow, exceedingly fragrant, and of high flavor. The skin is of a very fine texture. The cup of the stem end is very small, and often entirely wanting; that of the blossom end is not as large as in most other varieties, and is less corrugated. The superiority of the fruit in crates or cans has been well proved by the highest prices in the home markets as well as in the large cities. The time of ripening, early in October, has been found to suit all classes by coming to the tradesman and consumer between the earliest and latest, when the season favors its highest perfection. It has weighed as high as eighteen ounces on full-bearing trees, though twelve to fifteen is a good size, giving seventeen fruits to the rounded peck.

A Frenchman has this in his catalogue: "*Meech's Prolific.*—Remarkable for its productiveness, uniformity in size, regularity in bearing, and superior quality. It meets every requirement of a perfect quince."

10. Missouri Mammoth Quince.—This variety originated in Massachusetts. It was carried to Ohio, and from there to Kansas City, Missouri, by J. M. Slocum, who sold the stock to S. C. Palmer, by whom it has been disseminated. After being tested some twelve or fifteen years, it was accepted with so much favor as to receive the commendation of the Missouri Valley Horticultural

Society, and from that Society received its name. The description of the tree is, that it is a healthy and vigorous grower, very productive, and a regular bearer; that "when planted at one year old, and well handled, it will bear in five years," and "after it comes well into

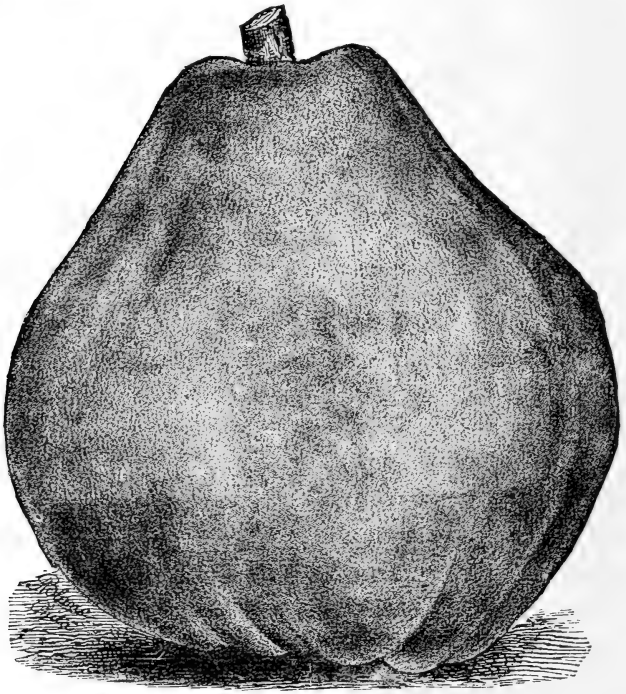


Fig. 10.—MISSOURI MAMMOTH.

bearing the yield is from one to two bushels per tree." The fruit, which "ripens about the time of the Orange, is very large, pyriform in shape, and very rich and aromatic." The stem is set in a broad basin, and the cup of the blossom end is deeply corrugated.

11. MUSK or PINEAPPLE QUINCE.—This is an old

variety, that produces a large fruit, but is now discarded. It had its celebrity in this country fifty years ago. The Musk was one of the sorts spoken of by Columella.

12. Pear Quince (*Cydonia vulgaris* v. *oblonga*).—It receives its name from being shaped like a pear, oblong, and tapering to the stem. The fruit is yellow, the flesh a little darker than the Orange, and much tougher, becoming woody around the core. It is of medium size, and though one of the oldest, is also one of the poorest varieties. It ripens much later than the Orange. Its

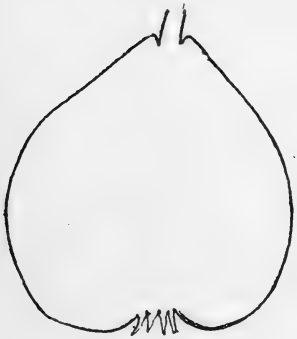


Fig. 11.—PEAR.

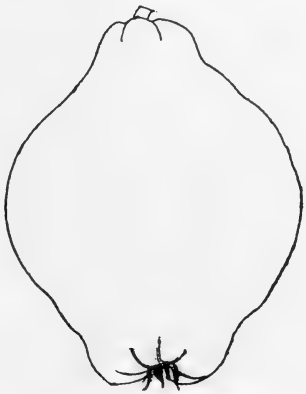


Fig. 12.—PORTUGAL.

chief excellence is its high flavor. It is now little cultivated, better sorts taking its place.

13. The Portugal Quince (*Cydonia vulgaris* v. *Lusitanica*) is the earliest ripening of all the varieties, being ten days earlier than the Orange quince. It is not a vigorous grower, but has been used for stocks. The leaf is a little longer and wider in proportion than the Orange quince. The trunk and branches are peculiarly marked by excrescences as smooth as those on the old Orange are rough. The fruit is large, a little oblong, tapering from the middle each way, like a Kieffer pear.

The quality is excellent. When cooked the flesh turns purple or crimson. The color of this variety is a very bright yellow. The reason it is so little cultivated is that it is so shy a bearer.

14. Rea's Seedling, or Rea's Mammoth, was raised by Joseph Rea, of Coxsackie, Greene County, N. Y. It is believed to be a seedling of the Orange, though in shape it is obscure pyriform. It ripens later than the Orange, and keeps very well after ripening. The flavor is excellent. It has attained a weight of twenty-two ounces in New Jersey's sandy soil. To attain full size the tree needs high culture with good thinning. But for the tenderness of the trees in some localities, this variety must have reached a much wider dissemination.

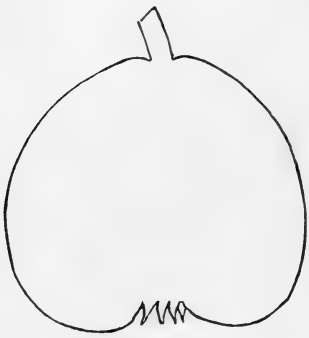


Fig. 13.—Rea's.

15. The Sweet Quince.—This variety is so named because the fruit is mildly acid and not very astringent. The tree is a good grower and bears abundantly. T. B. Jenkins, of Chambersburg, Penn., says this variety was raised from seed about 1830, and has been a regular bearer. The fruit is described as being medium to large, roundish oblate, and somewhat ribbed; color yellow, but not so bright as the Orange. The stem is set in a broad, dull brown, and rough, knob-like projection, while the calyx has large, long segments, set in a deep basin much corrugated. The flesh is firm and of a deep yellow, coarse grained, a little tough, and not very juicy.

CHAPTER IV.

SOILS FOR THE QUINCE.

THERE is a diversity of opinion as to what kind of soil is best suited for the quince. One class of observers, who have seen this fruit growing in high perfection in the rich accumulations washed down from the hill-sides for ages, insist on a moist or alluvial soil. Others, with a successful experience in a light sandy loam, may favor that. Others still, observing that quinces grow successfully on all kinds of soil, except dry sand or wet swamps, would plant it anywhere, from the low lands along the sea-coast, or margins of lakes and ponds, streams and rivers, to the higher plains and table-lands, or on the hill-sides and hill-tops of quite elevated locations.

This fruit has attained high perfection in the mountain regions of Georgia, and North and South Carolina. J. Van Buren, of Clarksville, Georgia, says: "It is not unusual to raise quinces five to five and a half inches in diameter, fair, smooth, and beautiful, and of high flavor."

The quince adapts itself to different soils and circumstances with remarkable success. The soil may have a preponderance of sand, gravel, or clay, and yet be rich in those fertilizing materials which adapt it to all wants. An analysis of the wood, bark, and fruit will show that the soil and atmosphere together have supplied it with potash and lime, soda and silica, alum and iron, magnesia and chlorine, phosphoric, sulphuric, and carbonic acids, and moisture. To these add decaying animal and vegetable matter, with needed water, light, heat, electricity, and the aërial gases, and we have the perfection of fertility. A heavy clay soil will be improved by the addition of sand or silica, because it will make it warmer, and more open and friable. A light, sandy soil, will be

made better by the addition of clay or alumina, because it will make it more compact and retentive of moisture. Lime and chalk will produce effects intermediate between the silica and alumina. The mechanical condition will be found quite as important as the chemical constitution of the soil. When the mineral elements of fertility near the surface become too much reduced or exhausted by long cultivation, it will be helpful to work the soil deeper, bringing up the reserve forces; or by the addition of a perfect fertilizer, the growth will go forward with success.

In selecting soils, the first choice should be a strong loam, with enough sand in its composition to make it work easy. In a deep, strong soil the trees should not be expected to come into as early bearing as in the sandy soil, because the greater vigor of growth does not so soon tend to the formation of fruit buds; but when they do bear they make up for any lost time by the abundance and quality of the fruit, and greater longevity, and immunity from disease. A gravelly loam, if not too gravelly, is the second choice, because it comes the nearest to the first in all the more desirable qualities. A light, sandy soil is the next choice. It is a very desirable soil on many accounts; and where it has a clayey subsoil, as in my Vineland orchard, excellent results may be attained. It is not every one who can have his choice of soils, and it must suffice to use the very best available. After an experience of over twelve years with a light, sandy loam, I am well satisfied with its advantages. It is easily worked, yields excellent returns, and maintains a healthy growth. The clayey soil is chiefly objectionable on account of its being often too wet and heavy. Where the clay is not in excess, this soil is capable of being drained and otherwise improved, so as to give promise of good results. If only the proper cultivation be given, any soil that will yield good crops of corn and potatoes

may be used for the quince. This is especially true all along the sea-coast of the New England and the Middle States.

In many sections of the country, soils of all these varieties will be found along the rivers. There will be, first, the alluvial of the river basin in a strip along the river bank, varying in width, and overflowed every year by freshets, which leave it more or less enriched by silt. Then, secondly, there will be the belt of sandy soil, usually a rich loam, suited for almost every kind of crop. Back of this, and rising on the hill-side, is the more sandy and gravelly land, of variable quality, and more affected by droughts. The middle belt is preferable for the quince, as, indeed, it is for most other crops. But on them all the quince will succeed by skilful management.

The quality of the fruit on a wet soil is much more woody and astringent than on a rich and well-drained soil. A wet soil is always inimical to successful fruit culture. If for any cause it is desired to plant trees where a wet and heavy soil cannot be properly drained, the ground should be raised enough for the surplus water to pass off; though it is doubtful whether any amount of drainage can make a spot so situated profitable for this purpose. Excessive moisture is as bad as want of water.

A soil that is too dry will retain needed moisture in the heat of summer by being well cultivated. A hard and shallow soil, by being worked deep, and thoroughly mellowed, will resist drought successfully. But if the subsoil be clayey we must not deepen so as to make the soil hold water like a basin. In deepening a clay soil very much we may necessitate drainage. Water-soaked roots are no better for the health of the tree than wet feet are for the health of man.

CHAPTER V.

MANURES FOR THE QUINCE.

WHATEVER can be used to increase the fertility of the soil by supplying plant food is a manure. The chemical analysis of any plant will show its constituents, and give the relative proportion of each, and so serve as a guide in supplying what that plant needs. About nine-tenths are water and air; the rest is made up of earths and metals, as lime, clay, iron, magnesia, silex, potash, and soda, with gases and combustibles, as oxygen, hydrogen, nitrogen, chlorine, carbon, sulphur, and phosphorus. In the process of growth the plant selects such of these as its nature demands; and when it dies and decays it restores to the earth these elements of fertility.

Artificial fertilizers are made by mechanically combining in desired proportions the elements of plant food, to supply any deficiency of the soil under cultivation. The action of any manure depends on its soluble salts. "The salts contain the sulphur, phosphorus, and carbon, as sulphuric acid, phosphoric acid, and carbonic acid, and the chlorine as muriatic acid."

All animal and vegetable matters in the process of decomposition form ammonia. It is estimated that the annual rainfall on an acre brings to the soil enough ammonia and nitric acid from the air to equal one hundred pounds of guano. The soil, to get the full benefit of this atmospheric manure, must be kept porous to receive it, and well drained that it may not run off on its surface. When fire consumes vegetation, its gases return to the air, leaving as ashes the earthy matters drawn from the soil. In the process of decomposition the result is the same, only the combustion is slower.

Wood ashes contain all the elements of plant food except nitrogen. Two and a half tons of seasoned hard

wood yield a bushel of ashes. In one hundred pounds of such ashes there are about sixteen pounds of potash, which is needful to good fruit. There are next three and a half pounds of soda, five and a quarter pounds of phosphoric acid, and sixty-seven pounds of lime and magnesia. A mixture of one part ashes with three parts of chip dirt is an excellent top dressing for the orchard. When the needed potash can not be had in wood ashes, a substitute may be made of the muriate or the sulphate of potash. Nitrate of soda and muriate of potash improve the quality of acid fruits. Lime is valuable in most soils by its solvent effects on the silica they contain. If lime be found in the ashes of a plant, it will be valuable as a fertilizer of that plant; and such is the case with all hard wood trees like the quince. It also improves the fruit.

Salt is so valuable to the quince, that it must be considered indispensable to its highest success. I no longer think of raising quinces without salting every spring before the trees begin to grow. I have learned not only to salt my quince trees, but my pear trees as well. It does them good not only in promoting a healthy growth, but I think acts as a preventive of the blight, to which both are subject. It may do this by its chlorine or by its soda, or by both combined, through the spongioles of the roots effecting a change in the sap and the wood. We know not how, but have found the effect favorable. Besides these effects it also promotes fruitfulness. I sowed about three quarts (the quantity for a tree large enough to bear a bushel) around a barren tree early one spring, and the year after it bore well, and so continued from year to year. Quince trees along the sea-coast may be expected to do well. Trees at Newport, Rhode Island, that were set for screens in exposed places, yielded excellent crops of very fine quinces. Salt acts as a solvent of other materials of fertility locked up in the soil. In

land fertilized a long time with superphosphates, there is an accumulation of fertilizing material that salt makes available. The lime and phosphoric acid lock up what the salt liberates. As good results were obtained with one quarter salt and three quarters phosphate, as from all phosphate without the salt. The salt and phosphate in equal parts produced a fine crop of corn on a mucky soil. Two hundred pounds of salt on three-fourths of an acre gave me the best crop of German millet I ever grew. It will be found valuable with quinces, pears, plums, peaches, and apples.

Heavy soils will usually be found to contain enough potash, but in an insoluble condition. Ordinarily a good top dressing of salt will make this potash available to promote a fruitful condition. The German potash salt, kainit, and muriate of potash will be found serviceable to most orchards. Nitrogenous manures stimulate the growth of leaves more than the fruit. The mineral manures, such as potash and salt, aid most in perfecting the fruit, especially the seeds, the thing of greatest effort in Nature's laboratory.

The value of any fertilizer is determined by the amount of potash, phosphoric acid, and nitrogen it contains. Nitrogen is expensive as an ingredient in the commercial fertilizer, and if it can be obtained free from the air, it will be a very great saving to us.

"The atmosphere is chiefly composed of oxygen and nitrogen; and water, of oxygen and hydrogen; and as there is always in the air more or less water, the element hydrogen is always present. Now under certain circumstances, the nitrogen and hydrogen combine in the air and form ammonia. The oxygen and hydrogen in the air are supposed not to be united in a chemical combination, but to form merely a mixture. Hence this nitrogen is called the free nitrogen of the air, as distinguished from that in ammonia, which is not free."

Accepting the theory of the chemists, that "somehow or other plants take nitrogen from the air," it is probable that they take it in the form of ammonia, and not as free nitrogen. But free or combined, it is evident from experience that most soils will be improved by the application of a quantity beyond all that is supplied from the air. The fact that the leaves of plants absorb gases should convince us that they may take nitrogen, either free or combined, though it does not combine very readily with other substances. Lawes and Gilbert, from experiments conducted *under glass,* concluded that plants could not take up the free nitrogen of the air. Professor Atwood, from experiments conducted *in the open air,* arrived at the opposite conclusion.

The supply of phosphoric acid from ground bones is never out of place in the quince orchard; and if the bones are first treated with sulphuric acid, their action will be more speedy. Bones in lye, or hard wood ashes kept wet for a very long time, will become useful without grinding, as they soften and crumble.

The quince is a great feeder, and has the faculty of using all kinds of manures. When I plant trees I fill the large holes with rich earth. The chip dirt of the wood pile mixed with the top soil of the hole is good. The surface soil of the poultry-yard to the depth of two or three inches is excellent. Road wash from the gutters of the highway does well; and better still are the gleanings of the street gutters of the village. Trees well set in these rich earths grow well to a bearing age, when they should be annually supplied with plenty of good manure. Their annual growth is a safe guide to needed treatment. If the shoots grow less than a foot every year, they need feeding or pruning, and probably both. Manure may be applied to the trees by all the usual methods at any season of the year, but better in the fall and spring than late in summer. Old and feeble trees have been

rejuvenated by liberal manuring combined with judicious pruning. A feeble or a starved tree, if it bear at all, will only yield small fruit of indifferent quality. As much as ten bushels of salt may be sown on an acre if the soil is good; but a poor soil will not bear heavy salting without injury.

Many will not be able to secure all the manure they need from common sources, and will of necessity have recourse to chemical fertilizers. To such I would recommend ammonia, about three per cent (the sulphate of ammonia may be bought, of twenty-five per cent purity); phosphoric acid, about ten per cent, equal to phosphate of lime twenty per cent; potash, about twelve per cent, equal to sulphate of potash twenty-two per cent; salt (chloride of sodium), about ten per cent, and lime five per cent, with about three per cent of magnesia. If they are not in the soil, add a little silica and iron. If the soil is heavy and clayey, the rest of the mixture may be sand or silica. If it is sandy, then muck will be found excellent. If the soil is in good proportions, these various fertilizers may be applied without being mixed, in quantities according to the judgment of the horticulturist. Full-bearing trees will be benefited by an increase in the amount of potash, as the fruit contains a much larger proportion of this than the wood. Decayed vegetable matter, or humus, in the soil acts as a solvent of all its mineral elements to make them available as plant food, especially the potash. Cotton-seed meal, with the addition of a little phosphoric acid and potash, is a good manure; but the cost will be considerably reduced by feeding the meal to cattle and using the manure.

CHAPTER VI.

LOCATION—TRENCHING—DRAINAGE—CULTIVATION.

LOCATION.—The planter should select the best spot at his command. In deciding which is best, he will need to consider well the kinds of soil as well as their location, and secure the greatest number of the conditions of success. If his valley is wet and subject to frost, he must go up on the hill-side, and, if need be, plant on the hill-top.

As to *aspects*, any may be selected when the other conditions are equally favorable. A northern aspect is to be preferred, where the season is long enough to insure the ripening of the fruit, because it is safer from late spring frosts. In the Middle and Southern States this will generally be the case. A southwest exposure will have advantages at the North, because, when there is a frost, the morning sun will be more gradual in its effects. For a like reason, trees near a large body of water escape frost by its ameliorating influence; and in case of frosts, the slight fogs that may rise soften the rays of the morning sun enough to prevent the injury of a sudden thaw. On the banks of a small stream in a deep ravine would be a bad location almost anywhere in the Northern States, because of the danger from frost.

TRENCHING.—One of the objects of trenching is to improve a soil that is too sandy by the admixture of clay from a suitable subsoil beneath it. If the subsoil is not clayey, then the surface soil must be improved by clay top-dressings and the coarser manures. If farm-yard manure has been composted with peat, swamp muck, or river mud, it is all the better. The trenching may be done either by the spade or the plow. If done by hand, go down twice the depth of the spade, and the work will

be efficient. If done with a plow, the furrow slice should be narrow, that the whole of the ground may be thoroughly pulverized very deep. Where we find a light sandy or mucky soil on a compact subsoil, it may be well to cross-plow, the more thoroughly to mingle the two together.

DRAINAGE.—Whenever it is found best to underdrain, the method should depend on facilities. Where there are plenty of cobblestones, it is a good plan to place them in a suitable ditch, and cover them so as to leave the surface much as it was before the drain was dug. This will be best in many parts of the country. In sections destitute of such material, tiles become a necessity. The ditch is better made between the rows of trees, so as to be reached only by the smaller roots; and for the same reason it is well to cover the joints of the tile. Three feet may be deep enough; but always make sure that the fall to the outlet is sufficient to carry out the water. Land that needs draining at all is never likely to be made too dry by good underdrains between the rows of trees. Some prefer open drains to tile or cobblestone. If proper drainage has not been secured before the planting of the trees, it will pay to do it afterward. The drains, however, must always be so placed as to carry off the water.

CULTIVATION.—The importance of thorough cultivation for this fruit can not be too well understood. Clean culture is helpful in avoiding the borers, because it leaves no weeds and grass around the tree to make a shelter for them. If the ground is stirred often, besides keeping it free from weeds, it will absorb a much larger portion of nitrogen from the air, and so be enriched. The atmosphere presses it into the soil with a weight equal to a column of water thirty-three feet high; and if it is constantly kept pulverized its power of absorption is greatly increased, and it is much less affected by drought.

The quantity of water evaporated from a soil well

tilled is surprisingly less than from a like soil untilled. The experiments at the Massachusetts Agricultural College, with a light sandy soil stirred four inches deep, showed an evaporation of 542 barrels of water in seven days from an acre, while a like soil undisturbed evaporated 1,276 barrels a week ; a saving of nearly 105 barrels a day. A heavy clay soil cultivated four inches deep evaporated 904 barrels an acre, while 1,020 barrels were lost from a similar acre undisturbed during the week; a saving of about 17 barrels a day by cultivation. Similar experiments in New York at the Experiment Station showed similar results. The crops that have been produced on a poor soil by most thoroughly working it are a demonstration of its great value to all crops. It may be well to stir the surface every week of the growing season.

CHAPTER VII.

LAYING OUT THE ORCHARD.

It is desirable to have the trees of an orchard in straight rows, not only for beauty, but for convenience

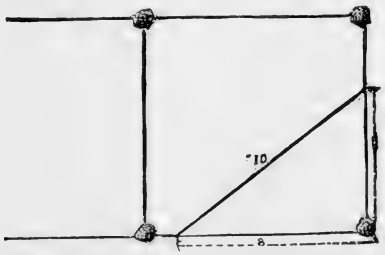


Fig. 14.—LAYING OUT IN SQUARES.

in cultivation. If the rows are begun crooked, the difficulty will increase as the planting progresses ; but if the

first row is straight, and the distance from tree to tree equal, the added rows are easily made to correspond.

The two methods of laying out an orchard are in squares, and in triangles and hexagons, commonly called

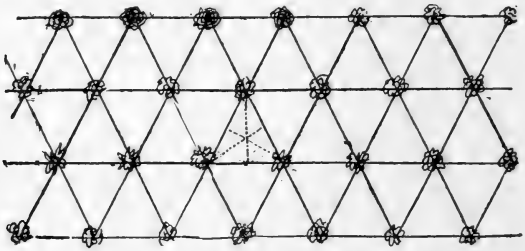


Fig. 15.—LAYING OUT IN QUINCUNX.

quincunx. Most orchards are laid out in squares, but in equilateral triangles the ground will hold about one-seventh more trees at the same distance apart. There is no way to set as many equidistant trees on an acre as in equilateral triangles. To lay out the ground in squares, the first thing is to form a right angle, which will be included between two lines six and eight feet long, con-

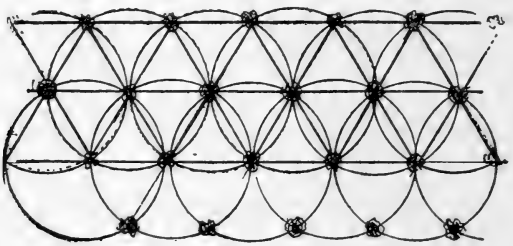


Fig. 16.—QUINCUNX BY CIRCLES.

nected by a third line ten feet long, as shown in the figure. Having formed this right angle, the extension of the six and eight feet lines will show where the rows of trees are to be planted at any desired distance. Parallel lines will show where to plant the successive rows till the

whole plot is planted. A ten-foot pole may be used instead of a line or cord to lay out the angle. If exact measurements are made there will be little need of sighting the rows.

The *quincunx* plan is simply to lay out the orchard in equilateral triangles. Whatever distance be decided on

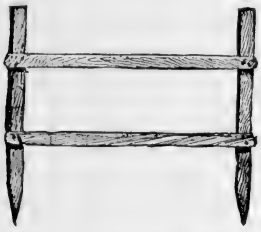


Fig. 17.—FIXED MARKER.

Fig. 18.—ADJUSTABLE MARKER.

between the trees will be the length of the radius of a circle, which can be easily swept with a cord of that length, or by a marker for this purpose. The fixed marker is made by nailing two light strips to stakes the width apart for the distance from tree to tree. The adjustable marker has one of the stakes movable on a bar, and fastened with a key at any desired distance.

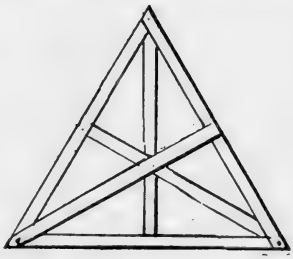


Fig. 19.—MOVABLE TRIANGLE.

I have found no way so convenient as to make a triangle of narrow boards the desired length, nailed at the ends, and with braces from each point to the middle of the opposite side, fastening well at the intersections. Having a base line, I move this triangle along from one tree to another, making holes and setting trees at the points. Repeat the operation for each row till the trees are all planted.

Besides the gain of about one row in seven over squares,

the quincunx plan allows of cultivation all ways, which keeps the ground in fine condition with the least labor. Laid out in squares fifteen feet apart, an acre will take

Fig. 20.—LOCATING BOARD.

two hundred trees; in quincunx, at the same distance, it will take two hundred and twenty-two trees. At twelve feet in squares it will take three hundred and two, and

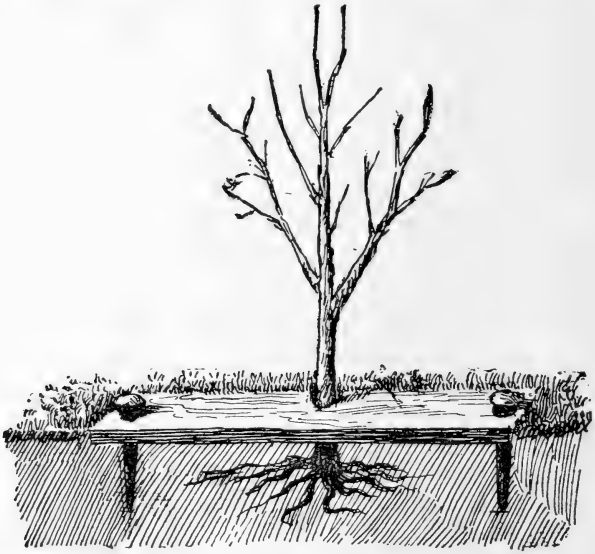


Fig. 21.—LOCATING BOARD IN USE.

in quincunx three hundred and seventy. At ten feet in squares it will take four hundred and thirty-five, and in quincunx four hundred and ninety-seven trees for an acre.

After the peg is placed for the location of the tree, it will be found convenient, when the triangle is not used, to have a board seven or eight feet long with a notch on one side in the middle and a hole at each end equidistant from the notch. Place the board so that the notch will receive the peg, and stick a pin through each hole. Lift the board, leaving the pins, and dig the hole for the tree. Replace the board on the pins, and set the tree in the notch, and it will be sure to stand where the marking peg was driven. With pins enough to do this, the entire orchard may be laid out before a tree is set.

CHAPTER VIII.

TRANSPLANTING THE QUINCE.

No part of culture is more important than transplanting, and, as generally practised, none is done so badly, or with less regard to the principles involved. The digging often robs the tree of nearly all its fibrous roots, and the planting crowds what few are left into the smallest hole that will hold them ; so that, between the careless digger, and the thoughtless planter, the tree dies ; or, if it lives, makes a feeble growth, and never affords satisfaction to any one.

How and *when* to transplant are the two chief points on which depend success or failure. In taking up a tree great care is necessary to preserve all its roots, large and small. If every root and rootlet could be preserved intact, and then well placed in the new location, there would be but little check to its growth. The nearer we come to this the better the prospect of success. The length of the roots being reckoned equal to the hight of the tree, we can tell about how far from the base of the tree

we should begin to dig to get under the outer portion of its roots. What is commonly called a forked spade is the best implement I have used, as it does not cut the roots, and bruises them but little. The digger should stand with his side toward the tree, and this fork will then go down so as to lift the roots entire, by working from the outer ends to the tree. The larger share of fibrous roots will be found comparatively near the surface.

As soon as the tree is dug, earth must be thrown over

Fig. 22.

Fig. 23.

GOOD AND BAD DIGGING.

its roots to keep them from drying by sun or wind. A cloudy day is desirable, and is all the better if damp and without wind.

If the tree has been raised from seed it will have a tap-root; but if from a cutting there will be only laterals to care for. If any roots are bruised or broken in digging, it will be well to pare off the bruised parts smoothly, and cut the ends of broken roots with a slant upward, so that the callus formed will emit roots downward from these cut ends.

The hole for the tree should be about two spades deep,

and wider than the roots are long. In most soils it pays to dig a hole from four to six feet across to plant a one year old tree, and still wider for older trees. Throw out the subsoil by itself, and either spread it around on the surface, to be acted on by sun, rain, and frost, or to be removed for other uses. The top soil is then filled into the bottom of the hole, and the tree set on this so as to be a little deeper than it was before. Fill in among the roots with rich soil rather than manure ; for though it may be well rotted, it will be generally too dry, and if fresh will injure by the fungi it produces. Rich manuring on the top of the ground after the tree is planted will promote a vigorous growth. When the hole is nearly filled, a very liberal mulch of leaves, straw, or any such material should be well spread in, and covered up with earth. It will prevent the tree from suffering in drought, promote the absorption of nitrogen from the air, and by rotting become a good fertilizer. If the tree has large roots, great care is needed to insure them against hollows that produce decay. A little water may be needed to make sure that the earth presses against every part. After the operation is well performed, watering on the surface will not be needed, as the mulch prevents evaporation. If so watered at transplanting as to get the earth well pressed against the roots, and then properly mulched, trees will never need watering again, except by natural rains.

How much room to give the quince depends on circumstances and surroundings, and the form of head desired. Such writers as Cole, Thomas, and Downing recommend six, eight, ten, and twelve feet apart. I have tried them all, and decided on fifteen feet as being close enough for the highest success. By studying the possibilities of this fruit, we must decide how wide we will plant. Sometimes a quince tree exceeds all expectation. In 1857 there was a quince tree near Geneva, New York,

that was thirty feet high, with a trunk six feet around, and had branches extending over a circle seventy-five feet in circumference. It was thought to be the largest quince tree on record. I have read of a tree on a thorn root that produced five bushels a year. On this root the quince is long-lived. But I have seen the trees over sixty years old on their own roots, and still bearing well.

The size of a tree most desirable for transplanting must necessarily vary with circumstances. As a rule, young and thrifty trees will grow best, because they lose a smaller proportion of their fibrous roots. Large trees are more likely to be checked by transplanting, because of the greater loss of roots. If the tree to be transplanted has not been cut back so as to reduce the top to a good proportion with the roots before being set, it must not be forgotten afterward, as much depends on this. If there has been a great loss of roots, as is often the case, it is better to reduce the top very severely, perhaps to one or two buds of the new wood. The tree will be larger at the end of the season's growth, and of better form.

A suitable preparation of the ground is more conveniently made before the trees are planted. No pains should be spared to so prepare the ground that it will exactly supply every want of the trees, and at once push them into a vigorous growth. If not well prepared then, no after labor can fully supply the deficiency. The importance of thorough work was illustrated by the experience of a man who had a hundred trees to set, and going from home for a day, left a man to plant them in his absence. Returning at night, he was offended with his help because he had only set nine of the hundred. So he discharged him, and next day planted the ninety-one remaining himself. But, to his surprise, when they bore, the crop from the nine was worth more than that

of the ninety-one. In tree planting, as elsewhere, "haste makes waste." If worth doing at all, it is worth doing right.

The quince should not be planted in grain or grass, and especially a clover sod. Low, hoed crops, like beans or turnips, can be cultivated among the trees when small, because their culture necessitates fertilizing and stirring the ground; but as soon as the trees get large, nothing else should be allowed to grow among them. If the roots happen to get frozen while above ground, they will die if thawed in the air; but if buried in the soil, and

Fig. 24.

Fig 25.

TWO METHODS OF HEELING.

allowed to thaw there, they will live and grow. To freeze and thaw in the earth does them no apparent harm.

If a tree has become dry and shriveled in transportation, its plumpness may be restored by burying both top and roots for a few days; but if put in water, it may become water-soaked, and so fail. The stem and branches of a newly transplanted tree may be greatly benefited by watering before the leaves appear, especially when there has been much loss of the roots. When the trees come to the planter from a nursery, it is best to heel them in at once; for there is no way in which they can be kept so well as in the earth. Once properly heeled in, the planter can take time to plant each tree.

Trees received in the fall for spring planting can be kept in this way in good condition, and will be ready to plant earlier than where the planter waits till spring before ordering them, because in the hurry of spring work some must necessarily wait.

If trees are heeled-in in bundles, those inside are not pressed by the earth, and become dry. If the trees slope toward the south, they will not thaw out as soon in spring, as the tips shade the ground toward the sun. Heeling-in erect is only recommended where there is danger from mice. The place for heeling-in should be high enough to secure freedom from all danger of the trees becoming water-soaked. A sheltered situation is most desirable.

CHAPTER IX.

WHEN TO TRANSPLANT—KEEPING A RECORD—EFFECTS OF WINDS—STRAIGHTENING TREES.

The best season to transplant is when the sap is comparatively dormant, between the fall of the leaves in autumn and the development of the buds in spring. To decide intelligently what is the best time to transplant we should, as far as possible, take into account the various agents that influence vegetation, such as the relative warmth of the soil and atmosphere, and the mildness or severity of the climate in winter. Then, again, the nature of the soil will be an important consideration, as also the facility for doing the work in the best manner.

The greatest difference between the mean temperature of the earth and the air is in October, when the earth a foot below the surface is from a degree to a degree and a half

above the mean temperature of the air. Some soils are much warmer than others, and serve as a natural hot-bed for the roots of the newly-set tree, encouraging the formation of a callus on cut and bruised roots as well as the emission of many new roots, and so preparing for a vigorous start in the spring, as well as a successful wintering. The greater cold of the air prevents the buds from starting until the warmth of spring, when vegetation generally becomes active.

Where the climate is too cold for the newly-set trees to carry forward the healing of cut and bruised roots, which is the case where winter sets in early, and the ground freezes as deep as the roots extend, there will be great danger from fall planting. The freezing and thawing of all heavy soils operates greatly to the disadvantage of all newly-planted trees. In warm, dry, and sandy soils, if the setting is well done any time before winter begins, or even during the mild spells of winter, success is a reasonable expectation.

The soil is cold in the spring, and is much more slowly heated than the air, which stimulates the buds, and new leaves are developed more rapidly than the roots, and, as a consequence, the reduced roots of the transplanted tree are heavily taxed to supply the needed moisture. Now unless the top was cut back in proportion to the roots, the tree will suffer, and may die. Often the spring-set tree leaves out as well as the fall-set tree, but suddenly dries up and fails because the roots can not supply moisture. It does not matter whether a tree is just set, or has been long established, if moisture does not get into its top as fast as it dries out the tree will die, in the summer or winter, fall or spring.

Trees set in the fall are in more favorable circumstances to get the benefit of the winter and spring rains to settle the earth among their roots ; and being thus established, they are ready to commence new growth in the first warm

days of spring. Now where this is delayed till spring, it is often quite late before the ground is ready to work; and if the season be backward, it is all the more important to have them in their places. Nurserymen generally not only send out the first choice in the fall, but give the trees a more careful handling, as they have more time at command. If not ready to set the trees, it may be better to secure the stock and heel in till ready.

Spring planting will suit better than fall in Northern latitudes, where the ground freezes very deep, or where the soil is heavy and heaves with frost. At the North the trees are liable to be thrown up by alternate freezing and thawing, and the roots are often injured by being saturated with water in a heavy undrained soil. If the situation is very much exposed, staking may save the rootlets from being twisted off. If delayed till spring, always do this work as early as the circumstances will allow.

KEEPING A RECORD.—When different varieties of quinces have been planted in the same orchard, it will be useful to preserve a record or map of the location of each variety, as the labels on the trees soon fade, and memory is not to be trusted in years of change. Such a record will be found valuable for the use of new proprietors, and, in case of the death or removal of the planter, will be of much importance. No system of labeling can be of equal value.

EFFECTS OF WIND.—Whether winds will benefit or injure trees will depend on their character, and the degree of force with which they move. The swaying of the limbs and branches of trees as they are moved by the common winds that blow in every direction are beneficial, serving for them the purpose that exercise does for the animal creation. All know that exercise strengthens and promotes growth, and only becomes injurious when it is

excessive. So with the motions of trees produced by winds, especially during the growing season.

"The mild wind blows
And beauty glows,"

but when the storm king rides on the wings of the wind in the sweeping hurricane, what was a benefit becomes an injury. Experiment has shown a diminished growth in the part of a tree not moved by the wind, and that wind-breaks are very desirable to prevent excessive sweeps of winds and storms.

STRAIGHTENING LEANING TREES.—Trees in an orchard are often seen out of an erect position, which may arise from winds or other causes. In all such cases it will add to beauty and the convenience of culture to straighten up the leaning trees. This is easily done by setting a stake a little distance from the tree, and then fastening the tree to it with a wire or cord, thus securing it in a perpendicular position during the growing season. I have found a single year's growth in the desired position all that was necessary for permanence. It is best to do this when trees are quite small; or, if large, when blown over, without delay.

CHAPTER X.

PROPAGATION OF THE QUINCE.

THE quince may be multiplied from seeds, cuttings, and layers. The seed of a species will always produce its kind, but the seed of a variety is uncertain. If propagated from layers or cuttings, or by grafting or budding, the trees will always be of the same variety as the parent tree.

1. PROPAGATION BY SEEDS.—All the recent varieties

of merit seem to be chance seedlings, which suggests that seed should be selected from the best specimens of the choicest varieties, that there may be still further improvement. Quince seed for planting should never be allowed to get thoroughly dried before it is planted. If not convenient to plant when taken from the fruit, preserve it in moist sand till spring, when, in a well-prepared seed-bed, it should be covered two or three inches deep, and treated as other seedlings. Any one desiring to improve the quince by seedlings will do well

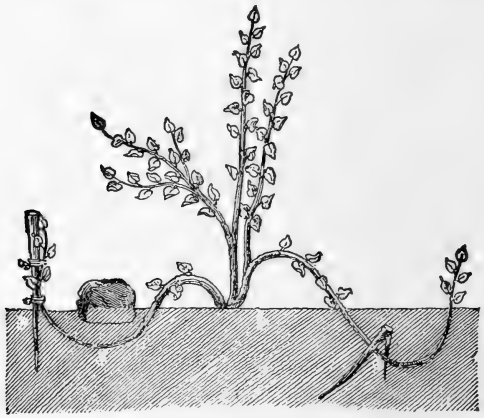


Fig. 26.—LAYERING.

to study the theories of Van Mons, of Belgium, and Knight, of England, as described by Downing.

2. PROPAGATION BY LAYERS.—It is a very simple operation to bend down a limb, and keep it covered with moist earth till it is rooted, and then cut it from the parent tree. If the bent branch is partly cut off or slit up under a bud, or twisted like a withe at the lowest point, it will help both the bending and rooting. A wire twisted around the layer just below the bottom bud in the ground, and holes punched through above and below

the wire, may help; or the holes may be made through the layer in the buried portion to stimulate its rooting from the callus of the wounds. The bark is sometimes cut nearly around the layer just below a bud, and bits of wood removed below this cut to induce the formation of a callus, from which roots are emitted. It is sometimes necessary to fasten down stiff branches with a forked peg or a weight. Young shoots of thrifty trees make the best layers. Early spring is the best time to put down layers, that they may be well rooted by autumn.

Mound Layers or *Stool Layers* differ from the others

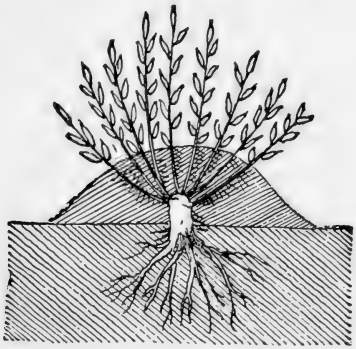
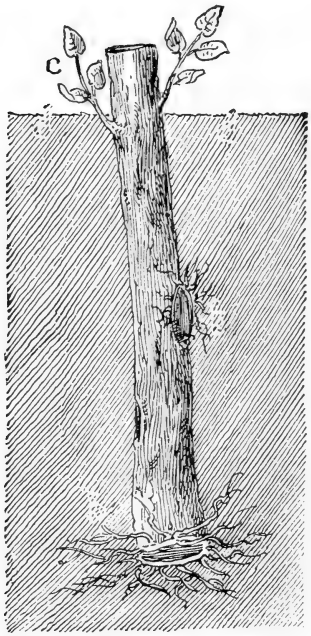


Fig. 27.—MOUND OR STOOL LAYERING.

by having the earth heaped up around them instead of being buried in the earth. The sprouts from stumps or around growing trees, being well banked up, will readily root as high as moist earth presses against them.

3. PROPAGATION BY CUTTINGS is probably the best method of multiplying quince trees. Cuttings of large branches are better than those of small shoots. The amount of wood seems to measure the vital force to form both roots and tops. From twelve to fifteen inches is a good length, enabling us to plant deeply, and so guard against drought. Small cuttings may be cut shorter, and

have a piece of apple or quince root grafted on to push them. The chief thing is to guard against the exhaustion of sap by evaporation until roots are formed. Facilities for regulating light, heat, air, and moisture with precision will enable us to succeed with a succulent cutting furnished with a few leaves. When the air is



Flg. 28.—LARGE CUTTING.

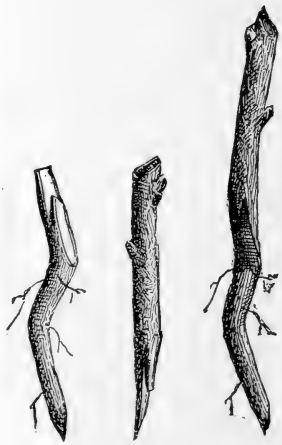


Fig. 29.—ROOT-GRAFTING.

warmer than the earth, buds are excited more than roots; and when the ground is warmest, root growth is most excited. Hence the custom of burying cuttings inverted during the winter, to keep the buds dormant while a callus is forming for the emission of roots.

In preparing the small cuttings to receive the pieces of roots grafted on them, the chief thing is to have their

cut ends fit, so that the inner bark shall match at least on one side and at the end of the cutting.

These grafted cuttings may be quickly dibbled in, making a hole deep enough to receive the whole length except a bud or two above the surface. Holding the cutting in the hole at the right depth with the left hand, push the earth firmly against the cutting with the dibble, as you would in planting a cabbage. For lack of such firming the earth there are many failures.

The fall, after the leaves have dropped, is generally preferred for taking the cuttings; but they may be taken

Fig. 30.—ROOT CUTTING.

much later. I have had some cuttings grow in the open air, which were made in May, after the trees were growing.

Root Cuttings a foot or so long are best prepared before the buds swell in spring. I have trees from pieces of roots cut off by the plow as late as June. Plant at an angle of about forty-five degrees, or as near as you can to their natural position.

4. PROPAGATION BY GRAFTING is successful where the inner barks of both stock and cion are made to fit together. A union forms most readily between varieties of the same species; next between species of the same genus, and is limited by genera of the same natural order. By this law one variety of quince will do best grafted on

another; and next on the apple, white thorn, and Juneberry. On the white thorn it escapes the borer.

The choice of wood for cuttings is last year's growth from near the center of the tree. Be sure they are from healthy and vigorous trees. If trees are propagated from bearing wood they will come into fruit sooner than if from blind wood. Here is a reason for the difference in the bearing age of trees from the same parentage.

Fig. 31.
SPLITTING KNIFE AND CHISEL.

Spring is the best time for grafting, except the root grafting already described. In March we work by the methods best suited while the bark adheres to the wood, and later by those suited to a bark easily separated from it.

Cleft Grafting is the most common method, and is done by cutting off the stock smoothly, and splitting it

Fig. 32.—CLEFT GRAFTING.

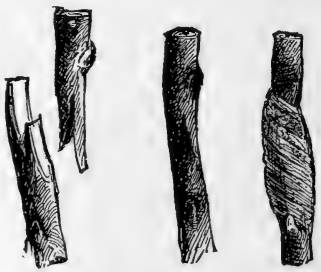


Fig. 33.—SPLICE GRAFTING.

down from an inch and a half to two inches, according to the size of the stock and the thickness of the cion. Into the cleft set the cion, with the end cut wedge-shaped, the outer edge a trifle thickest, and so placed that the liber or inner bark of the graft and stock shall

match; then bind and cover all exposed parts with wax or clay, and the work is complete.

Splice Grafting or *Whip Grafting* is only adapted to small stocks. If the stock and cion are of the same size, they will make a perfect match. If one is larger than the other, they will match on one side and end. Cut each with a slope about an inch and a half long, and make a tongue for convenience in matching the parts. Bind together and wax well.

Fig. 34.—SADDLE GRAFTING.

Saddle Grafting is a modification of whip grafting easily understood by the illustration.

Side Grafting is a simple way of propagation free from some of the objections to cleft grafting. It is a very convenient method of inserting a limb to restore a balance to the head, or provide shade for exposed

Fig. 35.

Fig. 36.

SIDE GRAFTING—TWO METHODS.

parts. The first method is like budding with the bud extended to a cion. The second is like cleft grafting, in a cut on the side of a tree or limb.

Crown Grafting differs from side grafting by having

the stock cut off as in cleft grafting. It is specially serviceable for stocks too large to split, and is best done

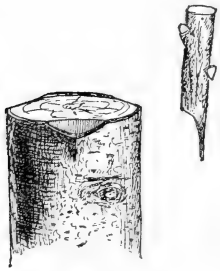


Fig. 37.

Fig. 38.

CROWN GRAFTING.

when the bark will slip. The stock is not split, but the tongue of the cion is slipped down under the bark as in budding.

The advantages of cions with only one or two buds are, that they do not dry as soon as longer cions, they

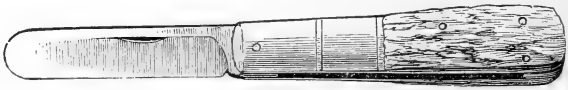


Fig. 39.—BUDDING KNIFE.

afford less leverage to winds, and are less liable to be injured by birds lighting on them.

Fig. 40.—BUDDING KNIFE.

5. PROPAGATION BY BUDDING follows the same law of affinity observed in grafting. The buds may be taken

from wood of the growing shoots well matured, or from the preceding year's growth. A cion too late for graft-

Fig. 41.—STICK OF BUDS.

Fig. 42.—CUTTING A BUD.

ing may be treated as a cutting till its buds can be used. The bark of a quince tree can be raised for the insertion of a bud most of the growing season. The best place to insert it is near a bud, or where a bud has become a branch, as the supply of cambium is there most abundant. The bud, with its shield of bark, is cut from above or below, beginning to cut half an inch off, and so cutting as to leave a thin piece of wood under the bud. On the stock cuts are made like a T. The corners of the bark being lifted, we slide the bud to its place, and complete the operation by winding a ligament of bass or raffia around the stock above and below the bud, tying it securely.

Fig. 43.—TRAINING A SHOOT FROM A BUD.
A, place to tie the stock to shoot; B, place to cut off the stock afterward.

Failure may arise from injury to the cambium in cutting and raising

the bark of the stock, from too narrow a cross-cut to receive the shield of the bud, from using immature buds, from the shield being too short (it should be at least an inch long), and from being loosely tied, so as to dry out. The south side of a stock is dryer in summer, and so is to be avoided.

CHAPTER XI.

PRUNING THE QUINCE.

In a natural condition we may regard it as a rule that the tree will maintain a harmonious relation of all its parts. The roots and branches will correspond with each other. Every twig, bud, or leaf removed from the top, and every fiber and spongelet cut off from the roots, will hurt or help the tree. No one is competent to reduce the roots, or diminish the leaves and branches, unless he possesses enough knowledge of the laws which regulate the action of the organs of vegetation to foresee the effect which will follow such removals. J. Lindley truly says: "If well-directed, pruning is one of the most useful, and, if ill-directed, it is among the most mischievous operations that can take place upon a plant."

1. Pruning at Transplanting.—As already stated elsewhere, all bruised and decayed roots should be removed; but the case is different with healthy roots. We must remember that every healthy and unmutilated root which is removed is a loss of nutriment to the plant, and that, too, at a time when it is least able to spare it; and there can not be any advantage in the removal. The top should always be cut back at this time, so as to preserve a balance in its proportion to the reduced roots. If we infringe on the reciprocal action which naturally exists

between the roots and branches, evil results will surely follow. The accumulated life-force sets the roots to forming new spongioles, and the buds to developing their leaves; the elementary substances, which the roots absorb, are acted on by the leaves, and the new material thus prepared extends both the roots and branches. If transplanting has been well performed, the tree will need little more pruning than would otherwise be desirable to promote a more vigorous growth; but if the roots have suffered in being dug, there will be a decided advantage in cutting back the new shoots to the fewest

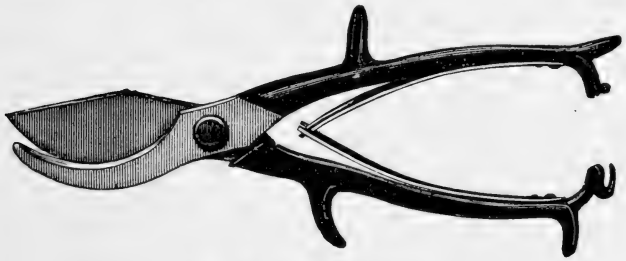


Fig. 44.—PRUNING SHEARS.

buds that will give the desired form to the head of the tree.

2. PRUNING FOR FORM.—The intelligent and observing horticulturist will find, by starting with a young tree, that he can secure almost any form desired, by judicious pruning. Trees make the most vigorous growth from terminal buds. By cutting off the shoots by upper and under buds the new growth will be upward or downward; and side buds will give a growth to the right or the left. Keeping in mind the general principle that limbs must not grow so as to cross and chafe each other, I have settled into the practice of cutting back all my trees annually, beginning when they are one year old, and following them up as they increase in size and multiply their branches. The

cut should be made far enough above the bud to insure its not drying out, and near enough to grow over the end as the tree enlarges. The age of the tree, and its thriftiness or feebleness, must be taken into account in determining how far back to cut.

The quince tree is naturally inclined to grow into a bushy head, but it also pushes up one or more leaders, and can be trained into a regular tree-form if that be desired. To secure an upright growth, cut back the leader to an inside bud. To spread out branches, cut so as to leave the bud on the outside. Clean off a large portion of the little twigs that multiply and die along neglected branches, and besides saving resources, you will

Fig. 45.—BUDS AND BRANCHES.

improve the smoothness and beauty of the limbs. The fact that so many of these die along the limbs is Nature's admonition to prune the tree. It is quite common for the buds along a vigorous shoot to develop threefold, and it will add to the beauty and symmetry of the form to begin with the young tree and rub off all but the strongest bud; and where limbs are not wanted, rub all off. This will direct the energy of the tree into the most desirable channels. It is worth while to go over a tree for this purpose a number of times during the growing season, because one strong shoot is worth more than two or three feeble ones having the same amount of material divided between them.

At *a* (fig. 45) are triple buds at a favorable age to easily rub off supernumeraries. At *b* they are so far developed as to need the knife to cut off the extras. At *c* we have the vigorous shoots growing as desired.

How much to cut back each year is a matter of judgment. In a shoot from one to two feet long, cut back about half the length. A growth of three to five feet may be reduced a little more than one-half. Treated in this way, the tree pushes vigorous side shoots, and makes a lower head, which is less affected by winds, is more convenient to keep in order, the fruit is easily gathered, and however heavy the crop, the branches are so stocky they never break. If a cone-shaped head is desired (and this is the ideal form of many), it can be secured by leaving the lower branches longest. The natural flow of sap to the upper branches will be diminished, and increased in the lower, and thus their growth will be proportionally increased. If the branches are nearer than four to six inches, cut out those worst situated, or least likely to be fruitful. A judicious thinning and shortening of crowded and irregular branches will promote both thrift and fruitfulness. When a shoot pushes so strongly as to attract to itself too much of the nutriment of the tree, pinch off the end, and repeat the operation till its buds push like those on the other shoots, till, by compelling an equal distribution of nutriment, all shoots grow in like proportions, if not equally.

3. Pruning to Promote Growth.—When a stunted tree is cut back judiciously, the remaining buds may be expected to grow with renewed vigor, because the forces of growth are concentrated on a smaller number of buds. The inner bark of a feeble tree is thinner, and the sap vessels smaller; the more concentrated growth thickens the bark and enlarges the sap vessels; and so there is a more ready flow of all the nourishing fluids, and a consequent increase of growth. In the laboratory of the leaves the

sap is matured, and as it descends through the bark to the roots it deposits the matter which is added to the tree; while the part of the sap not thus expended goes into the alburnum, and joins the upward current, communicating powers unknown to the recently absorbed fluid. What is thus true in regard to a feeble tree is yet more manifest in stronger and older trees.

To secure all the benefit, the pruning should be done in the winter, when there is the greatest amount of vitality stored up for use the coming season. In the latitude where the ground seldom freezes deep, the tree continues to absorb food by its rootlets, which is distributed over the branches. But when the prunings are wanted for cuttings, they will be found that much stronger for the same reason. I have never taken off cuttings for propagation earlier than December or January, though I have no doubt of their success when taken earlier.

I can not too strongly recommend a severe pruning of feeble young trees, both in the nursery and orchard. If we leave only a bud or two, the concentration of vigor may restore a healthy growth to the tree, which will continue as long as other conditions are favorable.

4. Pruning for Fruitfulness.—The general law is, that excessive growth and great fruitfulness can not co-exist in the same plant. Accordingly, a number of devices are employed to so far change the growth as to secure the formation of fruit buds. "The buds of fruit trees which produce blossoms, and those which afford leaves only, in the spring, do not at all differ from each other, in their first stage of organization, as buds. Each contains the rudiment of leaves only, which are subsequently transformed into the component parts of the blossom, and in some species of the fruit also." From the freaks in Nature's mode of operation, it is plain that, while the various parts of a blossom differ both in ap-

pearance and office from the leaves, yet, under some circumstances, they all assume the same appearance and office. Accepting this idea, we are still unable to explain how or why a given course of treatment causes a tree to convert a part of its buds into flowers, by forming their leaf-scales into calyx, corolla, stamens, and pistils, while its other buds become branches clothed with nothing but leaves.

The period of fruitfulness varies in different species of plants, and in different varieties of the same species. It is often in our power to advance or retard these periods by our methods of cultivation. The law as stated by Lindley is, "Whatever produces excessive vigor in plants is favorable to the formation of leaf-buds, and unfavorable to the production of flower-buds; while, on the other hand, such circumstances as tend to diminish luxuriance, and to check rapid vegetation, without affecting the health of the individual, are more favorable to the production of flower-buds than of leaf-buds."

(*a.*) *Root Pruning*, if performed at the right time, checks too vigorous growth in highly cultivated trees and renders them fruitful. How far from the trunk of the tree to cut off the roots must be determined by the size of the tree. Wm. Saunders recommends from three to six feet from the stem, according to the size of the tree, and to perform the operation by digging a circular trench, so as to cut off all the roots. He says: "If done in August, the supply of sap will immediately be lessened, the wood-maturing principle accelerated, and fruit-buds formed. The operation has been performed in spring with but little benefit, but if done in the fall can not fail in producing the desired results." F. P. Gasson cuts off the roots of a tree four inches in diameter, within two feet of the trunk, only leaving a circle of roots four feet in diameter; and this, too, after the leaves have fallen in autumn. He fertilizes liberally in the fall with solid

manure. The following spring and summer he waters well with rich liquid manure, especially if the weather be dry; and besides, gives an annual dressing of lime. As a result of this treatment his trees make short, stiff wood, well supplied with fruit buds. He thins out the small and poor fruit, and then allows the trees to bear full

Fig. 46.—FIVE YEAR OLD TREE BEFORE PRUNING (*From Photograph*).

crops. The pruning is done every second year, widening the circle of roots at each successive pruning.

The unproductive tree is sometimes brought into bearing by being transplanted. The check to growth stops the leaves from consuming the nutriment accumulated in the branches, and which they would have expended in making more wood, and so nutritious matter accumulates and fruit-buds are formed. The same principle is seen to operate in the abundant crops that follow the years

when trees have their crops destroyed by late frosts. An excessive crop so far exhausts the nutritious matter stored in the branches, that the tree takes an off year to recover and lay up for the next.

(*b.*) *Pruning the Limbs* to promote fruitfulness must of necessity be done in the summer, when it will reduce the young wood-growth, and so lead to such an accumulation of sap in the branch as will organize the remaining buds to produce fruit. "If of two unequal branches

Fig. 47.—FIVE YEAR OLD TREE AFTER PRUNING (*From Photograph*).

the stronger is shortened, and stopped in its growth, the other becomes stronger; and this is one of the most useful facts connected with pruning, because it enables a skillful cultivator to equalize the rate of growth of all parts of a tree."

This shortening of the growing twigs should be done when they are so tender they can be pinched off with the thumb and finger. If the next bud immediately pushes into another extension of the shoot, it will be necessary to pinch off again a little further on, even to the third

or fourth time. An excess of wood is the occasion of barrenness oftener than is supposed. The tree exhausts its strength in sustaining and extending its woody fiber at so many points, that it has little vigor left to form fruit-buds or mature a crop of fruit. Nature intimates this sometimes by all at once dropping off all the fruit that is set after an abundant blossoming. The outer branches are most fruitful as a rule; and if the head is kept open the fruit is better.

The two pictures of one of my trees are an illustration of such an experience. This tree, now eight years old,

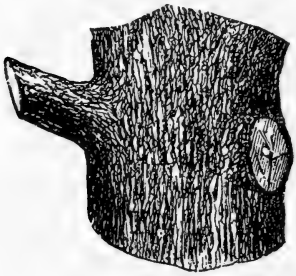


Fig. 48.
BAD AND GOOD PRUNING.

Fig. 49.
RESULT OF BAD PRUNING.

grew about sixteen inches from the cutting the first year, and was then transplanted, and cut back to within six inches of the ground. The second year it made a growth of four shoots of about five feet each; and these, in turn, were cut back to about three feet, throwing out the side shoots that form the head. When five years old it stood eight feet and five inches high before it was pruned. It has borne since it was three years old, the last crop being one hundred and twenty quinces, the two largest filling a quart can. The longest shoot grown with this crop was six feet and four inches, in the midst of several others only a little shorter.

I have thus far treated of pruning as it should be done with the knife or shears, before the limbs are large enough to need a saw. But when trees have been neglected till large limbs are to be cut off, it is important that they should be so cut as to give a good prospect of healing over; else they may be the occasion of decay going into the very heart of the tree. If the cut is made several inches from the body, there is no possibility of healing over, and decay is inevitable. On the other hand, if the limb is cut so as not to leave a projecting stump, it may grow over entirely in a few

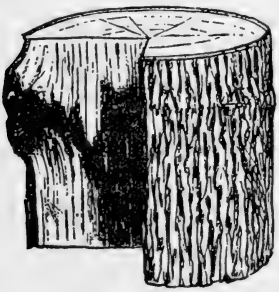


Fig. 50.—DECAY FROM BAD PRUNING.

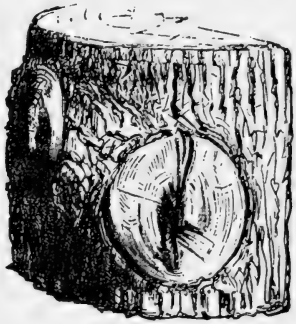


Fig. 51.—RIGHTLY PRUNED BRANCHES HEALED OVER.

years, especially if well waxed or painted. As a rule, if the limb cut off is an inch or more in diameter, it is well to cover the wound. Gum shellac dissolved in alcohol to the thickness of paint is as good as any thing to apply. It is very adhesive, soon hardens, keeps out the air and water, and is not affected by weather changes. It is too thin to hinder the lip of the growing bark from closing over the wound. Grafting wax, or a composition of equal parts of resin and tallow, melted and applied with a brush or swab, has been successfully used. A medicated tar, made by dissolving half an ounce of corrosive sublimate in half a gill of spirit, and then heating and

mixing in tar, is found excellent. If too thin to handle conveniently, mix in a little whiting or chalk dust. Sal ammoniac or spirits of hartshorn will dissolve the corrosive sublimate more easily than the spirit. It is an insecticide, and when a gallon of soft water is used in place of the tar it is a good wash to kill all insects and their eggs on the bark. If nothing better is convenient, a little grease of any kind will have a good effect on the wound.

If a limb bleeds when it is cut off, it may be worth while to apply *Knight's Composition* of four parts scraped cheese with one part of shell lime, or other pure lime. pressing the composition strongly into the pores of the wood. With this he found he could instantly stop the flow of sap in the largest branch. The worst time to prune is when the sap begins to flow actively in the spring. By contact with the air it sours and becomes poison to the bark. We ought not to close this topic without suggesting, that when the smaller limbs and twigs are cut off a good sharp knife is not always the most desirable implement to use. It often slips and injures what is not intended to be cut away. Small limbs can be pruned more rapidly with a good pair of shears.

CHAPTER XII.

PROMOTING FRUITFULNESS WITHOUT PRUNING.

1. This may be done by restricting root growth by pruning or cutting in the roots, as described on a former page, and need not be repeated here.

2. Bending down strong-growing branches without fruit-buds, has been found to retard the circulation of the sap sufficiently to induce fruitfulness. The pendant form becomes fixed by a single season's growth, and may be so skillfully arranged as to secure symmetrical and

ornamental trees. July and August are favorable months to tie down. The branches are secured to pegs driven in the ground. All kinds of trees and plants may be induced to flower and fruit, no matter how luxuriant their growth, by a judicious use of the bending process.

Fig. 52.
RINGING.

3. *Ringing the branches.* This is done by taking off a ring of bark wide enough to arrest the circulation of the sap, compelling it to accumulate above the ring. The same effect is often produced by a ligature made of wire. The effect is to produce early maturity in the fruit and an increase in its size, but at the expense of its quality. There seems, however, to be no use for this operation on the quince.

4. Grafting is a method of inducing early fruitfulness. A cion from a young seedling may be grafted on the limb of a bearing tree, and thus be brought into a fruitful condition much sooner than if left on the seedling stock. This is advantageous in testing new varieties.

CHAPTER XIII.

FLOWERS AND FRUIT.

It has long been observed that a very full blossoming often results in but little fruit; sometimes none at all. Why is it thus? A variety of causes may operate to produce the failure of fruit. If the weather be so unfavorable as to prevent the blossoms from performing their appointed work, failure is inevitable. When the weather is very dry while the trees are in bloom the fructification is often too imperfect to set the fruit, and the blossoms dry up and drop off. Or, on the other hand,

if there happens to be a long wet spell just at the time of blossoming, I have observed that the beating rain prevents the blossoms from performing their natural office of fructifying, and failure follows. For the pollen of the stamens to become perfectly matured, it is necessary that the blossoms have a few days of favorable weather after they are expanded, to enable them to fulfill their office. A tree may appear to have but a few blossoms, but with favorable weather for all to become perfected, so that each produces fruit, there may be an excellent crop. As a rule we want our trees to carry too much.

Again, blossoms will be found to fail because of the severity of the preceding winter. It may destroy the germs of the fruit without killing the other parts of the blossom. In such cases, all will appear to go right for a time; but, as with other things in nature, the antecedent cause will ultimately produce its legitimate effect, and the beautiful blooming proves to be only the forerunner of disappointed hopes.

Still again, a tree may blossom abundantly, and the fruit set and grow for a while, but all at once the whole falls off. This may arise from the tree being too feeble to sustain the crop set. Like a man with too heavy a load for his strength, he carries it all a little way, and then drops it exhausted.

Once more, it will be noticed that some varieties are more likely to fail after a full blossoming than others growing near them. This is chiefly owing to the difference of vigor and fruitfulness in different varieties.

A study of the peculiarities of the different varieties is of great importance to the cultivator. It is a matter of interest to observe that the great number of blossoms provided for in the economy of nature is to secure the certainty of fertility. Many will dry up and disappear as soon as they have done their fructifying work, while those attached to the stems bearing the fertilized fruit

do not so soon disappear. The petals retain their color and stand out with prominence so long after the others have withered away as to suggest a second blossoming.

CHAPTER XIV.

THINNING THE FRUIT.

THE story is told of a man who said it took him thirty years to get moral courage to prune his fruit trees. A large proportion of cultivators never attain the courage of their convictions in this matter. By far the most expeditious method of thinning fruit is to prune judiciously. In some varieties, after having pruned quite severely, there is too much fruit set to be carried to maturity, and a large thinning out is a necessity to prevent the trees from overbearing. To many, it seems an unjustifiable waste to pull off the finely-set specimens; and with a serious doubt as to the wisdom of the operation, they allow their trees to overbear. As an inevitable result, the fruit is small and inferior, the trees are overtaxed in the effort to mature more than they are able to perfect, and, as a consequence, they must have an off year to rest and recuperate. We hardly realize that a tree is overbearing till the fruit has attained considerable size, and then we hate to pull off enough to relieve the strain. I sometimes take off half or two-thirds, and then there is a plenty left to be of the first quality. The number of bushels will be about the same, and the quality of the fruit greatly improved. In years of abundance the large fruit will sell when the small finds no market at any price. This difference in the market value of fine fruit and that produced by overbearing trees shows the great importance of properly thinning.

The thinning of quinces should not be done till we can judge pretty well which would fall of themselves; and this generally shows quite well by the time they are as large as a man's thumb. Whether this natural thinning is the effect of insect stings, or of dry weather reducing the moisture below a sufficiency, or of a natural selection securing "the survival of the fittest," is not always easy to determine. Besides all these reductions, it will often be best to remove many others from very prolific trees. If, for any cause, thinning has been delayed till the fruit is quite advanced, still it is best to do it, and relieve the strain on the tree. By combining with this thinning of the fruit a thorough cultivation of the soil, a poor variety may excel a better one that is neglected. This will be more especially observable in young trees. They seem to be more easily affected than when older. But even the old trees seem to be rejuvenated and show fruit improved beyond their possibilities under neglect.

It is hardly necessary to say that deformed and imperfect specimens are first to be removed, with any that show signs of insect stings; and that all wormy fruit should be destroyed or placed where the worms will die. Deep burial in the earth will generally kill them; so will fire or water. If taken as early as it ought to be, the green fruit will have little value as food for any kind of stock.

CHAPTER XV.

GATHERING AND MARKETING.

If the trees have been properly pruned annually, it will be a long time before they are too high to reach the fruit from the ground. When, in time, the fruit is

borne too high to reach, a common step-ladder will be found convenient. A cheap and convenient step-ladder may be made out of two pine boards, six inches wide and one inch thick, for sides. The steps should be of the same width, and mortised into them, with a wider board for the top. The bottom should be wide enough to stand firmly, and the top only wide enough for standing room, with a basket for the fruit.

The stave basket, being smooth inside, and therefore less liable to bruise the fruit, is preferred to the old splint or chip basket. The size used to be for five half

Fig. 53.—A CHEAP STEP-LADDER.

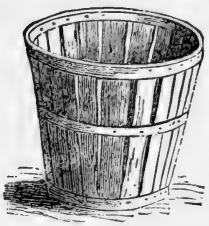


Fig. 54.—STAVE BASKET.

pecks, but now it is generally for four. The old standard crate for shipping fruit was eight inches wide, fourteen deep, and twenty-three and a half long, outside measure. The ends and partition were cut from three-quarter inch pine, seven and a half wide by fourteen inches long. The bottom and top were six and a half wide, and three-eighths of an inch thick. The sides were of four slats of the same thickness, and two and a half inches wide. The whole crate consisted of thirteen pieces, often with a planed end for marking. These proportions are varied, some being wider and shorter, or narrower and deeper,

according to the choice of the shipper or maker. Crates being seldom returned as "*empties*," they are about enough less in capacity than the bushel to cover the cost of the crate. Baskets are now returned, but probably will not be much longer.

For marketing, as well as for home use, quinces should not be gathered until fully ripe, as they do not, like apples, pears, and peaches, ripen up in color and flavor after they are picked. If gathered too early the quince is comparatively worthless. If the cultivator of the quince does not desire at once to dispose of his fruit, the later ripening sorts can be kept for a long time by being carefully spread out in a cool chamber till the frost necessi-

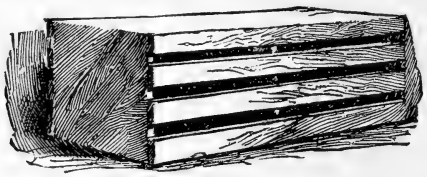


Fig. 55.—FRUIT CRATE.

tates their removal to the cellar. With proper care quinces may be kept till April in common cellars. Of course, with retarding-house conveniences all fruits may be kept at will. As a rule, it will be found that the best time to use or sell quinces is soon after they are ripe. If kept too long the demand for them, as with most other fruits, ceases, and they are not sought for.

There is always a market for quinces in the large cities, and, if the quality is good, at paying prices; but often the best market will be in some of the smaller cities and towns. The producer will find it advantageous to look out for such markets before the fruit is ripe, so as to know just where to send it when ready. There is a class of customers who always want the best fruit, and are willing to pay for it. The best is found in the end to be the cheapest.

CHAPTER XVI.

THE PROFITS OF QUINCE CULTURE.

THE profit of quince raising depends, first, on the variety raised, some being too unfruitful to ever yield profitable crops; next, on the skill and care of the cultivator, the best varieties being unprofitable when neglected; and, lastly, on the demands of markets. Hitherto there has been a market for even poor quinces; but as crops increase, only good fruit will be in demand at paying prices.

N. Ohmer, of Dayton, Ohio, reported, in 1869, that he had two acres in quinces; that three-fourths of an acre, ten years planted, had yielded crops six years regularly; and that in 1868 he gathered from three-quarters of an acre 300 bushels, which he sold at $2.50 a bushel, wholesale. A New York cultivator of the Rea's Mammoth raised on a third of an acre a crop worth $500. I have found a ready market for quinces when well put up in both tin and glass cans, at paying prices, in the markets of New York, Philadelphia, Baltimore, and smaller cities.

My first planting of the Meech's Prolific was only eight feet apart, quincunx, and the trees averaged half a peck when five years old; doubled it the next year, and trebled it when seven years old. Taking one year with another, my entire crop has averaged $2.50 a bushel. I found, when the trees were eight years old, that they averaged $1.22 a tree that year, being about $450 an acre. The Rea's has yielded a crop next in value to the Prolific at my place in Vineland, N. J.

By the report of the New Jersey Horticultural Society for 1884, it will be seen that C. L. Jones had a yield of 782, making seven and a half bushels, from two trees in his yard at Newark. He sold many of them at $6 a hundred, realizing $22.50, besides having 200 for himself

and friends. The two trees had been ten years planted, and show what can be realized from the most favorable conditions of growth and marketing. From the prices reported in several other States, the successful cultivator of this fruit could not fail to make it profitable.

CHAPTER XVII.

DISEASES OF THE QUINCE.

Diseases in trees arise from a variety of causes, such as insect depredations, loss of vitality from bacteria, and fungi preying on the living tissue; or there may be organic disease reproduced from unhealthy stocks and seeds. One form of existence is destroyed to produce another. The elements of life by death and decay enter into new forms of life. Disease in one department of nature may provide for a want in another.

The chief known causes of disease in quinces are *bacteria* and *fungi*. They are both low forms of vegetable life, the first multiplying by the division of a single cell, the second producing several spores in a cell. Of the various *bacteria*, each acts in a way peculiar to itself. Some produce disease, some act as ferments, others assist in the ripening of fruits, and still others aid in the regeneration of organic matter to form cell-structure.

The *fungi* are cellular, flowerless plants, which receive their sustenance from the earth or the organized bodies on which they grow. They differ from other plants, in general, in chemical composition, being chiefly nitrogen instead of carbon; and in their method of growth, absorbing oxygen and giving out carbonic acid. All the higher forms of plant life may have one or more of these low forms to prey on it as a parasite by its absorbing

roots or mycelium, or live within it as a saprophyte. A healthy tree possesses sufficient vigor to resist the attacks of diseases, and may grow on successfully when a feeble tree would be destroyed. A fungus may be so concealed in the tissues of a plant on which it is thriving, that its presence will only be known by the mycelium cropping out with spores on the surface.

1. QUINCE BLIGHT.—It seems to be well established that this disease, also called *fire blight* and *twig blight*, is the same as the *pear blight* in the pear and the *apple blight* in the apple. The disease has been produced in the June-berry (*Amelanchier Canadensis*), the English Hawthorn (*Cratægus Oxycantha*), and the Evergreen Thorn (*Cratægus Pyracantha*), by inoculation, and may probably be so produced in any member of this family of trees. Every part of the tree above ground is subject to its attacks. It may extend only to tender twigs, or it may entirely destroy the tree. The presence of this disease may be recognized by the granular appearance of the bark on the tender twigs, accompanied by the exuding of a gummy substance, of a peculiar odor, quite sticky to the fingers in the morning after a heavy dew, and drying up so as to glisten in the sun, when it forms into granulations on the discolored bark. This gummy substance, as seen through a microscope, resembles filamentous threads, each being strung with sacks of bacteria, ready to burst and scatter their infinitesimal germs by the aid of the lightest breeze, or to be washed to the earth by summer showers. The author was aided in examining this gum from a blighted twig by Prof. J. B. Ellis, author of "North American Fungi," and it was found that so little as could be picked up on the point of a penknife, put into a drop of water on the glass slide of his microscope, revealed an innumerable number of spores, or bacteria, too small to be described. The stomata of a leaf, examined at the same time, was large enough to

take in a dozen of them at once. Hence the ease with which the disease may be spread.

Prof. J. C. Arthur, botanist of the New York Agricultural Station, who has given much time to the study of this disease, suggests that "The bacteria escape from the tissues in the slimy drops that ooze out from the diseased parts, especially in damp weather. They are washed off and freed from the viscid part by rains, and upon becoming dry are taken up by the winds. Being now suspended in the air, a damp day, dewy night, or light rain would bring them in contact with the delicate surface tissues of fresh cracks or wounds, in the most favorable way to introduce the contagion. This is quite in accordance with the fact that the disease usually starts at the ends of the branches, but also appears sometimes on the larger limbs, and even the trunks. It also explains the fact that the rankest growers are most subject to attack, these exposing more tender surfaces, and, upon the disease obtaining a foothold, furnishing more succulent tissues." Insects are almost sure to carry the disease wherever they go, after contact with these exudations.

The theory that ascribes the blight to bacteria is so well proved that it is needless to notice the older theories which obtained before 1880, when Prof. T. J. Burrill, of Illinois, began experiments to demonstrate this. "The bacteria connected with pear blight are all of one kind, and of only one kind : not the bacteria of putrefaction or of animal diseases, but a kind that have never been found anywhere except in blighted fruit trees. These have been named *Micrococcus amylovorus*. The former word, the generic name, means very minute bodies; the second, or specific name, means that they are lovers of starch. They are very minute vegetable organisms, and live on starch or similar substances. They multiply by dividing into two, like the figure 8; these divide again, this process of division and subdivision going on very rapidly."

The bacterial theory seems to account for all the phenomena connected with this disease. The bacteria found in the disease will produce it from inoculation in about a week; and by the second week the stem and leaves of the twig will be dead, and by the third week the disease will be extended down the limb, marking its progress by the brown bark and blackened leaves peculiar to the blight.

Bacteria may enter through the flowers as well as the tender tissues of the growing twigs, or any opening in the older bark of the trunk and limbs. No visible effect is likely to be seen for several weeks. In June, and onward for a number of months, it may be seen as branch after branch reveals its presence. It grows very slowly in cold weather, and rapidly in warm and moist weather.

I have found the annual salting of both quince and pear trees, when done before the spring growth begins, to operate as a preventive; but can not say there will be none in the future. *Later* salting has not always prevented it. When the disease is manifest, no time should be lost in removing and burning the diseased portions. Be sure to cut far enough below the affected parts to remove all the disease.

So long as there remains any portion of the trunk or branches not encircled with the blight, the tree may recover. I have trees that have done good service for several years, which were all destroyed except a strip on one side. The diseased parts were cut away, splitting off the blighted wood from one side of the trunk, and the rest has grown well, now nearly covering the split portion.

Accepting the bacterial theory of the disease, we might propose to control it by spraying the trees with some antiseptic; but in practice the best thing we can do is to prevent it as far as possible, and diligently destroy every trace of the disease.

The microscope shows that both leaves and fruit are

more or less protected by a coating of natural varnish, supposed to be wax or silica. Whatever it may be, it is best to observe what soils and fertilizers supply it. Ashes and lime are found to improve the quality of fruit, and it may be assumed, also, that they increase the vigor of growth, and so aid in resisting the attacks of bacterial and fungoid diseases.

2. Orange Rust (*Ræstilia aurantiaca*, Peck; *Centridium Cydoniæ*, Ellis).—This fungus affects the stems and fruit of the quince in June and onward. In a single

Fig. 56.—STEM AT A BUD AS AFFECTED BY THE RÆSTILIA AURANTIACA.

instance I have seen it on the leaf stalk. The spores are of a beautiful orange color, globose in shape, with a membranous envelope, and are produced in sacks or pustules, which form an enlargement on the stems, resembling the black knot of plum and cherry trees. The little blackened quinces remaining on the trees after the leaves have fallen, attest its destruction of the fruit, and warn us against its neglect. Once in a while a stem survives its attacks, and so of the fruit. As the disease progresses the granules burst, forcing their sides upward,

and opening out with a multitude of cups, notched at the edge, and shedding a profusion of yellow dust, which, as it falls, reminds one of the shower of sparks from an ascending rocket. The cups are bell-shaped, edged with a pretty fringe around their margins; and are so numerous as to entirely girdle the twig or half cover the fruit.

These cups, called peridia by mycologists, appear to have burst through the outer covering of the bark on

Fig. 57.—STEM BETWEEN BUDS AFFECTED BY THE RÆSTILIA AURANTIACA.

the twigs and the skin of the fruit. The cups sometimes rise a tenth of an inch above the surface, with the lower parts attached to the substratum. The bursting peridia shed a liberal shower of their golden dust around them, which is scattered by the winds, carrying the spores, or, more strictly, the protospores, because they produce the true spores or fruit, so that each grain of this dust is the seed of more of these epiphytal plants. Before the oidium or fungus bursts out in the clusters of cups so prolific of dust, the surfaces of affected parts show numer-

ous little elevations or pustules, which become ruptured as ripeness is attained, when the fungus pushes through the opening, at the same time bursting by radiating fissures, and forming a fringed edge of the cups. The fringed edges are often recurved, revealing the orange spores crowded together within. At first, and while contained within the peridium, they are concatinate or

Fig. 58.—FRUIT AND STEM AS AFFECTED BY THE RÆSTILIA AURANTIACA.

chained together; but when dispersed they are scattered about the orifice, and often mixed with the colorless cells from which they have issued.

A slice of the fruit cut out before the fungi are matured enough to burst the cells, shows the yellow color of the dust in its granular formation, as confined by the cellular substance of the cups. Each of the protospores con-

tained within the peridia may germinate, and produce not only one, but many vegetative spores, which are exceedingly minute, and may be regarded as the embryos of a fresh crop of fungi. If a vertical section be made, the fungi will be seen to spring from beneath, the spores or protospores being clustered at the bottom. The tooth-like fringe is only a continuation of the cellular substance of the cups.

It is possible that the fluid parts of the spores are absorbed by the growing plant, and as the result, the plant has become inoculated with the virus, which is so destructive as often to discourage the horticulturist. It

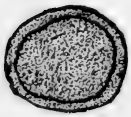


Fig. 59.—SPORE OF THE RÆSTILIA, MAGNIFIED 400 DIAMETERS.

Fig. 60.—ALLORHINA NITIDA.

requires a great stretch of the imagination to reach the possible limit of their mysterious increase and consequent injury.

The spores of the *Ræstilia aurantiaca* are from twenty-five to thirty thousandths of a millimeter in diameter.

The only effective remedy yet discovered, is to gather and burn the affected parts of stems and fruit before the spores are scattered to spread the disease.

The *Ræstilia aurantiaca* on twigs attracts the common green and brown dung beetle, *Allorhina nitida*. It is a *scaribæidæ* about the size of the common brown May beetle, and very strong. This beetle, though a friend to

the quince cultivator, sometimes eats into corn and various fruits.

3. Quince Leaf Brownness (*Morthiera Mespili* v. *Cydoniæ*, C. and E.).—This fungoid disease of the leaves is indicated by reddish-brown spots, which show on both sides of the leaf, with a small black speck in the center of each spot, which speck, on being magnified, appears to be four spores in one, each of the four being elliptical, and ending in a thread as long as itself. The

Fig. 61.—LEAVES AFFECTED BY MORTHIERA MESPILI.

rounded spots extend into coalescing brown patches, sometimes covering a large part of the leaf. The enlargement of the spots is due to the extension of the mycelium of the spores, which, as the disease progresses, kills the leaves, and they drop to the ground. The older leaves generally show the disease first, and from them it extends toward the ends of the branches, sometimes nearly defoliating the tree. It occurs on trees of every age.

In studying this disease, Soraner put some spores on a

healthy pear leaf, which there germinated, and in two weeks produced the brown spots with the black specks in the center. In the winter he found on the fallen leaves

Fig. 62.—MORTHIERA MESPILI, MAGNIFIED 400 DIAMETERS.

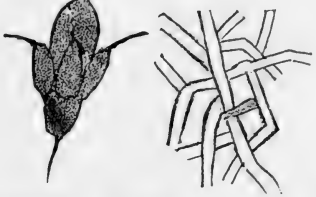


Fig. 63.—MYCELIUM OF THE FUNGI MAGNIFIED.

what he thought to be the same fungus, producing another set of spores (ascospores), which became ripe in April and May. Such fungi are able to grow slowly through the winter, ready to spread the disease on the new leaves in the spring. He also found the fungus capable of wintering on the bud-scales, without entering on a second stage of development. Young and weakly trees are more susceptible to its attacks than stronger growing trees. The pear and thorn are also subject to its attacks. The only sure remedy is to gather and destroy the leaves.

4. YELLOW LEAF SPOTS (*Hendersonia Cydoniæ*, C. and E.).—This is another fungus on quince leaves, resembling the *Morthiera mespili*, except that the spots on the leaves are yellow and produce a thickening of the leaf, with a development on the under side of the spots like the bursting of the cluster cups of the *Rœstilia aurantiaca*, only smaller. The spores are elliptical, marked with three bars across, dividing them into four

Fig. 64.
HENDERSONIA CYDONIA, MAGNIFIED 400 DIAMETERS.

parts, as shown in the cut. The destruction of affected leaves is recommended, especially as many of them are also affected with both of these fungi together.

5. Leaf Mildew (*Podosphæra tridactyla*, Wall).—This disease consists of a parasitic white mildew spreading interlacing filaments over both surfaces of the leaves, but developed most perfectly on the upper side. The disease appears in June, producing a multitude of colorless spores, which spread the fungus rapidly to other leaves and trees. Late in July it produces its fruit

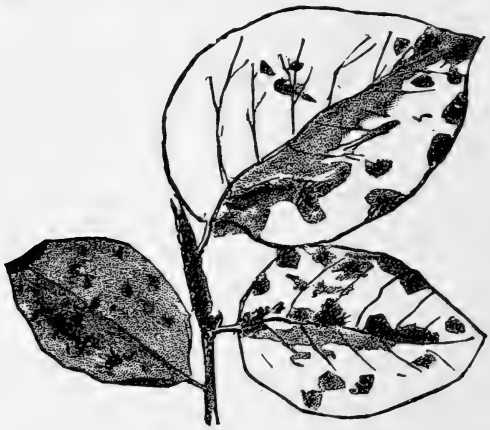


Fig. 65.—LEAVES AFFECTED BY THE HENDERSONIA CYDONIA.

as so many dust-like dots of regular form and size. These round, dust-like specks are the sacks which contain the resting spores, which withstand the rigors of winter, and reproduce the leaf mildew the next year. It is most thrifty on the leaves of a vigorous tree; but, with the favor of shade, may thrive on a weakly tree. It is also found on the leaves of apple trees, and proves very injurious to cherry leaves, often causing them to fall prematurely. Sulphur dusted on the leaves when they are wet is recommended as a remedy.

6. Leaf Blight.—This is very unlike the leaf blight of the apple and pear. The specimens examined have not yet revealed to us the cause. It first appears on the edges of the leaves ; sometimes on one side only, but more generally reaching nearly all the way around the leaf. At first it is of a reddish brown ; but as it extends inward toward the mid vein, it gradually assumes a deeper hue, till at last it is almost jet black, and covers very nearly all the blade of the leaf. As the disease progresses the

Fig. 66.—LEAF BLIGHT.

edges of the tenderer leaves curl upward, and eventually the whole dies and falls.

7. Quince Rot (*Sphæropsis Cydoniæ*, C. and E.).—This disease usually begins at a few points on the surface of the fruit, and spreads regularly in enlarging circles until the whole fruit is decayed. As these spots enlarge, the centers grow dark, and soon may be seen as a mass of black points, which contain a multitude of brown spores, each capable of spreading the disease. A sound quince

being inoculated with a piece of the surface of one diseased, the spores germinated, and the rotting slowly progressed to the twenty-second day, under a bell glass, when the decayed spot was an inch and a half in diameter, and showed fruiting points of the disease.

So long as the wax-like covering of fruit remains perfect, it is difficult for the spores of disease to affect it; but the sting of an insect, the abrasion of a chafing limb, or a bruise will make a way for the germs of disease to enter. Hence the importance of great care in handling the fruit. No other preventive is known for this disease.

8. Bark Bound or Hide Bound.—This may arise from the depredations of scale insects weakening the vitality of the cells, or it may arise from an undue reduction of the top in pruning or grafting, producing a disproportion between the leaves and the numerous cells under the bark, by which their expansive force is weakened too much to push out the bark; or injury to the roots may so far weaken the power of these cells that they become unequal to the task required of them. Provision is made for the expansion of the bark by the formation of cork-like cells, called *suber cells*, which expand so as to rupture the outer bark, and allow a proper enlargement of the growing tree. Every tree has its own suber cell, and so the rifts in the bark of each are according to its own peculiar character, no two appearing just alike. When, from any cause, the tree has become *bark bound*, a slit of the knife will help in doing what these cells failed to perform. The slit should be very carefully made, lest, instead of helping, it injure the tree by its severity. Be very sure the malady exists before the remedy is applied, or great harm may follow.

CHAPTER XVIII.

WINTER-KILLING.

THERE is a difference in the hardiness of quince trees. Some varieties endure severe freezing better than others. A variety that lives one winter may die the next because of the changes surrounding it; and so a tender variety may live, when one naturally more hardy dies. Sudden changes often work disastrously. This was seen in the winter of 1853–4 in a belt of country extending from New York to Michigan. Quince trees and pear trees on quince stocks were greatly injured by rapid successions of very warm and intensely cold weather. The result was, that nearly all the trees that were not sheltered were destroyed, or so weakened that they continued to die till late in the summer. The warmth had promoted sap circulation, and the sap, suddenly freezing, formed little crystals in the wood, which lacerated the fibers by every motion of the swaying trees. This cause may be supplemented by such a freezing and thawing of the limbs and branches as dries the life out of them. In all such cases the injury to trees will be in proportion to the exposure, and so the protection of good wind-breaks is of great importance. In that season of such widespread loss, those trees that chanced to be sheltered from the winds escaped. It was also observed that the loss was not so great with trees on clayey soil that shed off the water, as on sandy soil that was filled with water.

Trees transplanted in the fall, too late for the cut roots to heal, and for all to resume their normal functions, may in consequence fail to supply their tops with needed moisture, and they will become shriveled and winter-kill in consequence. The newly-set tree badly planted may suffer by the frost lifting its roots out of

their places, in which case it is likely to be winter-killed. A mulch sufficient to protect the roots from freezing during the winter is a wise precaution, not only to protect the newly-planted trees from intense cold, but will be a safeguard against winter-killing in those well established. It has been found highly beneficial to trees to have a mantle of snow cover the ground all winter, because it protects the ground from sudden changes. A winter rain freezing on the limbs will do little harm, unless accompanied by winds, because there is no danger of drying out the sap. The cold may be severe enough to weaken the vitality of fruit-buds, and they may all drop off after they have blossomed.

Trees are able to endure greater cold in a dry atmosphere than in a moist one. In elevated situations, trees will endure a severer temperature than in valleys or low down the hill-sides.

It will operate favorably to so cultivate the trees as to secure an early growth and ripening of the wood, that it may be in the best condition to endure the severity of winter frosts. When stimulated to grow very vigorously late in the season, the young wood is more likely to suffer than that produced earlier in the season.

The thermometrical and hygrometrical conditions act together, and the hardiness of trees will be determined by the power of the tissues to withstand the pressure that will burst them if they contain too much sap, or to shrivel them by drying out their moisture, and so destroying their vitality.

A wise precaution against winter-killing in sections where there is danger, is not to cultivate late in the season. The culture that stimulates a late growth of soft wood that does not ripen before the severity of winter sets in is to be avoided. The immature wood is easily injured, the grain is ruptured by freezing and thawing, and the disorganized cells in spring are no

longer able to perform their office. Secure an early growth of wood, that will ripen in time to be ready for all changes of weather, and you will have the satisfaction of having done wisely.

CHAPTER XIX.

INSECT ENEMIES OF THE QUINCE.

Entomologists have estimated that, on an average, there are from four to six insect enemies to each variety of plants. The insect enemies of the quince exceed this average, but are not so numerous as the enemies of the apple. Quite a portion of them are alike the enemies of both.

ATTACKING THE TRUNK AND BRANCHES.

1. The Round-headed Apple-tree Borer (*Saperda candida*, Fabr.; *Saperda bivittata*, Say).—This is an American insect, first described by Thomas Say in 1824. Trees growing on high ground are, other things being equal, more largely infested than those on low land. In its larval state it is called the Round-headed Apple-tree Borer, to distinguish it from a flat-headed species, which also preys on the apple, but not on the quince tree. In its imago, or perfect state, it is commonly known as the Two-striped Saperda. The full-grown larva is about an inch long, cylindrical in form, fleshy, and tapering from the head to the tail. The round head is of a chestnut-brown color, horny, and polished. The jaws are quite black, and fitted to cut the fiber of wood much as it is cut in boring with an auger. The chrysalis is lighter colored than the larva, and is marked by transverse rows of minute spines on the back, with a few at its extremity, which probably aid it in casting off its pupa skin. The

insect, in all its stages, will be readily recognized by the accompanying illustrations.

During the months of May and June this beetle emerges through a round hole, having completed all its changes from the egg to the imago. It comes out in the night, and hides during the day among the leaves, which are now its food. The sexes pair at night, after which the female deposits her eggs in the bark at the collar of the tree. The eggs are the size of a small pin-head, and may be looked for from May till August. Their entire life history embraces about three years. Within about

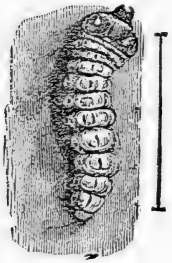


Fig. 67.—*Larva.*

Fig. 68.—*Chrysalis.*

Fig. 69.—*Beetle.*

ROUND-HEADED APPLE-TREE BORER.

two weeks from the laying of the eggs, they hatch into a larva, which penetrates through the bark to the sap-wood the first season, where they form a burrow, and may often be detected by the discolored appearance of the bark of young trees, or by the fine-grained castings they have pushed out of their holes. They remain in the tree three years, becoming each year more destructive. Before the end of this time, as they approach the completion of their larval growth, they cut a passage through the heart-wood of the tree, extending it outward to the bark. These passages are cut very direct up to this point for a future exit, or they may be found turning abruptly back in any direction. With an instinct bor-

dering on intelligence, the larva now fills the upper part of its hole with its woody dust against the bark; then turns round and fills it below with woody fibers of the heart-wood, when it again turns its head upward, and there rests till, in the next spring, the matured larva casts off its skin and reveals the chrysalis. In three weeks more the pupa has become a beetle, the soft parts soon harden, and in a few days it makes its way through the castings in the upper end of its passage, cuts a smooth round hole through the bark, about three-sixteenths of an inch across, from which it escapes.

Remedies.—The best remedy is to prevent the beetle laying the eggs in the bark of the tree. This may be done by wrapping petroleum paper, or any like substance, around the collar of the tree, letting it reach from the ground high enough to protect it. Alkaline washes have been found distasteful to this insect; and a wash of strong soap-suds thickened with washing-soda will keep it away. Wash as early as May and June, and keep the ground clear of grass and weeds for a harbor. I have found clean culture a good protection when neglected trees were badly infested, and some were destroyed. A good formula for a wash is two pounds of soft soap and a quarter of a pound of sulphur in a pail of water. Apply with a swab or brush.

Christopher Shearer, a very successful horticulturist of Pennsylvania, recommends a wash of four gallons of whitewash, two quarts of clay, two quarts of fresh cow dung, and one quart of strong lye, with water enough to mix well. Scrape the earth away from the collar of the tree, and apply with a swab or brush in May and August, reaching well up the tree. Return the earth that was removed. He finds it effective with the peach and apple trees as well as the quince. The main thing is to prevent the laying of the eggs, and this does it.

Harris recommends plugging up their holes with cam-

phor. Downing advises to heap ashes or lime about the collar of the tree. He would protect nurseries by washing young trees with a solution of a pound of potash to a gallon of water.

If the larvæ have already got into the trees they should be dug out or destroyed in their holes. Annealed wire or small strips of whalebone have been found useful to run into the holes. Besides the summer examinations, it is well to look over the trees in the fall and winter to make sure the larvæ are not in them.

2. THE QUINCE SCALE (*Aspidiotus Cydoniæ*, Comstock).—This is an enemy found on quince trees in Florida. The scale is gray, and somewhat transparent. The shape is convex and the size only about six hundredths of an inch across. The remedy is a strong solution of potash or soft soap, applied with a swab or brush.

3. THE WOOLLY APHIS (*Aphis lanigera* or *schizoneura*, Hausmann).—The downy plant lice, now placed in the genus *Eriosoma*, are among the most destructive species. This aphis was imported on fruit trees from Europe, and yet in England it is called the American Blight. It is most commonly found on apple trees in the colder sections. It was on the quince tree in an apple orchard at Northampton, Massachusetts, where it attracted my attention some years ago. The tree had numerous shoots like those that spring up around apple trees, and these were abundantly infested. I am thus particular in giving the location, as I have not seen it on quince trees farther south, and have not seen any notice of it on the quince by other writers. It may be readily recognized by the woolly covering from which it takes its name.

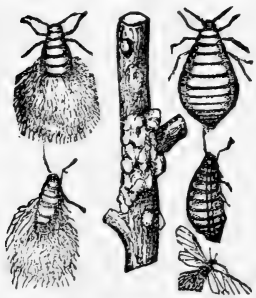


Fig. 70.—WOOLLY APHIS.

(See figure 70.) The numerous punctures they make in the bark of the tender shoots produce warts or excrescences on the bark, till the limbs become sickly, the leaves turn yellow and drop off, and sometimes the whole tree dies.

Remedies.—The lady-bugs and their larvæ, the larvæ of the Syrphus and lace-winged flies, and the little chalcid fly (*Aphelinus mali*, Hald.), all feed on these plant-lice. The old bark should be scraped off wherever it makes a harbor for them, and then with a stiff brush they should be treated to a solution of lime and sulphur (five pounds of lime to one of sulphur in two gallons of water, heated till the sulphur is dissolved). The earth at the roots, as far as practicable, should be exchanged for fresh soil. A pound of potash in a gallon of water is effective. Another application is made, melting three ounces of resin with the same quantity of fish oil, and applying it warm with a paint brush. Spiders spin their webs over and feed on them at their leisure.

4. The Seventeen-Year Cicada, commonly called Locust (*Cicada septendecim*, Linn.).—This insect derives its name from the time it requires to pass through its several changes. The long intervals at which they appear, and the little damage they do to the quince, make any extended description of the seventeen-year locusts, however interesting, quite unnecessary here. It may be found in any good work on entomology. The damage done by these insects can not be prevented. They can not eat, and the only injury they do above ground is confined to the small branches in which they deposit their eggs; but when they go over a whole tree in this way it becomes a serious matter. These branches die and fall off, and there is nothing to do but trim off the rough ends with a smooth cut. In the larva state they do much injury to the roots of trees. The birds, poultry, etc., destroy many. The plow destroys more in culti-

vated grounds. The work of these interesting insects, however, is confined chiefly to our native woods, and their numbers, consequently, can not easily be reduced.

CLIMBING CUT-WORMS (*Agrotidæ*).

CUT-WORMS are the caterpillars of widely-spread species of nocturnal moths. Most of them confine their depredations to young and succulent plants, which they cut off just above or below the surface of the ground. Four species of this numerous family are in the habit of ascending trees at night, and doing serious damage by eating off the growing twigs and foliage. Orchards in light sandy soil are most liable to their

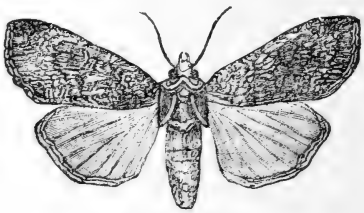


Fig. 71.—MOTH.

attacks. While the several species differ in size, in color and markings, both in the larva and imago state, they are much alike. In their general appearance they are smooth and naked larvæ of some shade of gray, green, brown, or black, with dusky markings. The female lays about 600 eggs on the twigs of the trees, where they do their mischief. They eat at night, and are, therefore, seldom seen. Having finished their nocturnal meal, they fall to the ground, and hide in the earth.

5. THE VARIEGATED CUT-WORM (*Agrotis saucia*, Hubner). The moth, with wings expanded, measures about an inch and three-quarters across. The fore wings are grayish brown, marked with brownish black. The hind

wings are white and pearly, shaded toward the margin with pale brown. The chrysalis is of a deep mahogany brown, with dotted markings on each side, and sharp

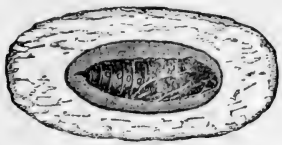


Fig. 72.—CHRYSALIS OF THE VARIEGATED CUT-WORM.

Fig. 73.—LARVA OF THE VARIEGATED CUT-WORM.

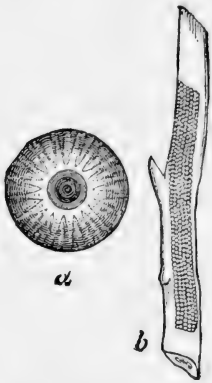


Fig. 74.—EGGS OF THE VARIEGATED CUT-WORM, *a*, Magnified; *b*, Natural Size.

pointed at the tip. The larva pupates in the ground, where it forms a smooth, oval, earth cocoon. The larva becomes full grown by the middle of June, when it is of

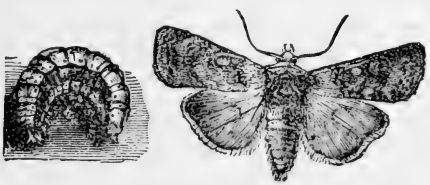


Fig. 75.—LARVA AND MOTH OF THE DARK-SIDED CUT-WORM.

a dull flesh-color, mottled with brown and black, having elongated velvety black markings on the sides.

6. THE DARK-SIDED CUT-WORM (*Agrotis Cochranii*, Riley). The moth is light gray, marked and shaded with brown, and smaller than the Variegated. The larva is a little over an inch long, with dark ashen gray sides and

lighter color above. The chrysalis in the earth cocoon is about seven-tenths of an inch long, yellowish brown with darker brown markings.

7. The Climbing Cut-Worm (*Agrotis scandens*, Riley) is very destructive to buds and tender stems and leaves. The body of the moth is about seven-tenths of an inch long, and the spread wings measure nearly an inch and a half across. The fore wings are of a light bluish gray with darker markings. The hind wings are pearly white. The larva is about an inch and a half long, of a light yellowish gray, variegated with dull green. It has a dark line along the back, with fainter lines along the sides. The spiracles are black. The chrysalis is brown.

Fig. 76.—AGROTIS SCANDENS.

8. The Mamestra Picta, or W-marked Cut-Worm (*Agrotis clandestina*, Harris), feeds on succulent plants, low bushes, and the buds of trees. It is supposed to have two broods a year. The first transformation of the chrysalis to the moth occurs about the first of June and the second near the end of August. The fore wings are of a dark ash-gray, marked by deeper colored lines, making their zigzag course a distinct W, near the outer hind margin. The hind wings are a dull white, faintly tinged

Fig. 77.—W-MARKED CUT-WORM.

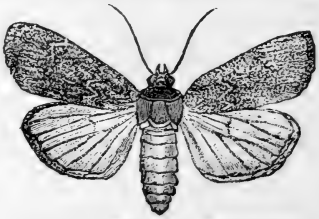


Fig. 78.—MOTH OF W-MARKED CUT-WORM.

with brown on the outer edge. The chrysalis is of the shining brown color common to the species. The larva is light yellow, variegated with three broad, black, longitudinal stripes, one on each side, the other on the top of the back. The head, belly, and feet are tawny. The lateral black stripe consists of numerous transverse black marks on a pure white ground. On account of its stripes, Dr. Melsheimer called it the zebra caterpillar. It does not conceal itself in the ground until it is ready to pupate.

Remedies.—The common red ants capture and kill them. Insectivorous birds devour them. As prevention

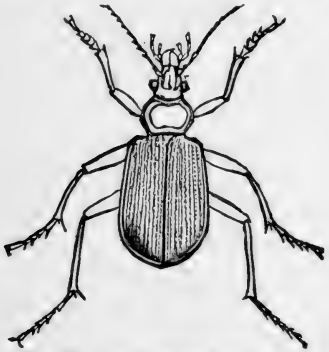


Fig. 79.—CALOSOMA SCRUTATOR.

Fig. 80.—CALOSOMA CALIDUM.

is better than cure, we may attract the moths by little bonfires, and destroy them. We may attract them by cider, and water sweetened and flavored with vinegar. We may keep the larva from climbing the trees by fastening around them strips of tin or zinc like inverted funnels. Cut-worms, like other caterpillars, have destroyers in the Tachina flies, and the Ichneumons are their parasitic enemies. I discovered one of these climbing worms a few years ago in the very process of destruction by parasites. The worms crawled through the skin, leaving no visible mark, and then spun their cocoons on

the stem that supported the cut-worm. Further observation showed that they pupated ten days before coming forth to repeat their work of destruction. The female of this parasite lays about 100 eggs, which shows that they are capable of doing much good service. The carnivorous beetles *Calosoma scrutator* and *Calosoma calidum* (Fabr.) are very active in hunting and eating all the species of cut-worms. The latter is a very beautiful beetle, with copper-colored spots on the wing covers. Their aid as destroyers of noxious insects should be better known and appreciated.

ATTACKING THE LEAVES.

9. Caterpillar of the Handmaid Moth, or the Yellow-necked Apple-tree Caterpillar (*Datana ministra*, Drury).—Of all insects that prey upon the leaves of quince trees, I have found the caterpillar of the Handmaid Moth most destructive. As one of

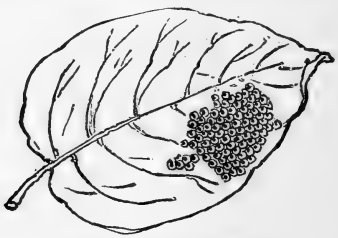


Fig. 81—EGGS OF MOTH.

its names suggests, it is also destructive of the foliage of the apple and also of the cherry. The eggs are laid on the under side of a leaf, selecting one near the end of a twig. They are fastened in nearly straight rows to one another as well as to the leaf. They vary from about 150 to 180, each the size of a small pin head. They hatch at varying times from July onward, occasional broods coming out as late as September. At first they only eat the

pulp of the leaf, leaving a pretty network of veins; but in a few days they devour the whole leaf, and when full grown sweep every thing before them. Side by side in solid phalanx along the twigs and branches, they feed

Fig. 82.—BEFORE THE FIRST MOULT.

Fig. 83.—BEFORE THE SECOND MOULT.

Fig. 84.—BEFORE THE THIRD MOULT.

Fig. 85.—BEFORE THE FOURTH MOULT.

Fig. 86.—AFTER THE FOURTH MOULT.

gregariously, resting between meals in the same order, with both head and tail recurved over the body. If touched or otherwise disturbed they at once throw their heads from side to side in a spiteful manner, or let themselves down by a silken thread, always double, which they rapidly spin out of their mouths. Their bodies are

Fig. 87.—LARVA AT REST.

Fig. 88.—CHRYSALIS.

well covered with long, soft, whitish hairs. They moult four times, and attain their full growth in five or six weeks, and are then about two inches long. A black stripe extends along the back, and three black stripes

alternate with four yellow ones on each side. With expanded wings the moth measures about two inches across, sometimes two and a half.

The sexes have some points of difference. The antennæ of the male have two rows of fringe beneath, with very short hairs nearly to their tips. In the female the antennæ are naked. She is larger than the male. Their color is a light brown. The head and a large square spot on the thorax are dark chestnut brown. The hairs on this spot can be erected so as to form a kind of crest. The fore wings are slightly notched on their hinder margins, with from three to five transverse brown lines, and one or two dark spots in the middle (sometimes

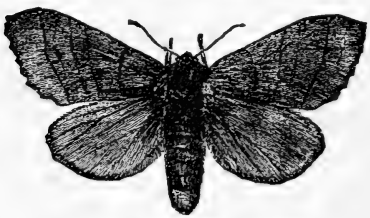


Fig. 89.—HANDMAID MOTH.

Fig. 90.—PARASITIC FLY.

lacking), and a short, oblique, dark line near the outer margin. In repose, the hinder part of the body is raised up, and the fore-legs stretched out before the body. The illustrations will aid in recognizing them at every stage of their life history.

Remedy.—They are easily found by the naked limbs they have stripped of their foliage, and also by their droppings on the ground, and when found can be pulled off and crushed. The Tachina flies deposit their eggs in them. A small Ichneumon is also known to prey on them.

10. THE FALL WEB-WORM (*Hyphantria textor*, Harris).—The appearance of web-tents in trees after the tent caterpillar of early spring has disappeared, has raised the question whether there be not a second brood.

But the tent caterpillar of spring only preys on a few kinds of trees, while the later sort are ready to work over a very wide range. They are much smaller, and eat very much longer. The fall web-worm is a caterpillar of the family of Arctians or Tiger moths. The name Hyphantria means a weaver, and is very appropriate and descriptive; for the first thing they do when hatched is to spin a web on the leaf where they are hatched, under which they eat the pulp of the leaf. Their webs are so closely woven as to hold their excrements as a fine powder.

The moth is white, with tawny yellow fore-thighs and dark-colored feet. The antennæ of the males are doubly feathered beneath, and those of the female have two rows of teeth on the under side. The expanded wings meas-

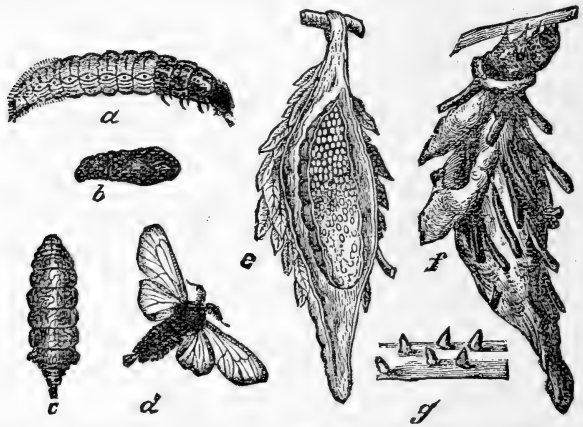
Fig. 91.—*Larva.* Fig. 92.—*Chrysalis.* Fig. 93.—*Winged Insect.*
FALL WEB-WORM.

ure about an inch and a quarter across. In repose they are not crossed on the back, but are roofed or sloped down on each side of the body. It only flies at night, when it lays its eggs on leaves near the end of the twigs, during June and July. In the North there is but one brood a year, but in the South there is often a brood in June and another in August. These caterpillars feed on the quince, apple, pear, and a good many other trees and shrubs. They attain their full growth in about three months, when they separate to seek places of concealment, where they pupate in thin and almost transparent cocoons, in which they remain through the winter as chrysalids. The full-grown caterpillar is over an inch long, with a slender body. Their general color is gray, with a tinge of greenish-yellow. Trees defoliated by

them are likely to be barren, because it is too late to form new foliage with fruit buds.

Remedy.—Gather and destroy them in their webs. The Spined Soldier-bug (*Podisus spinosus*, Dallas) pierces their bodies with its beak, and sucks them empty. There are birds that pierce their webs and destroy them in spite of their concealment.

11. The Bag-Worm, Basket-Worm, or Drop-Worm (*Thyridopteryx ephemeræformis*, Haw).—The bag-worm



a, Larva; *b*, Chrysalis; *c*, Female; *d*, Male; *e*, Female bag opened; *f*, The Worm and its Bag; *g*, The Young.

Fig. 94.—THE BAG-WORM, BASKET-WORM, OR DROP-WORM.

of the United States has a range from Alabama on the south to Massachusetts on the north. The Germans call it Sack-trager (sack-bearer). It feeds on almost every variety of trees, including the quince. The names applied to this caterpillar are significantly descriptive. No sooner is it hatched than it begins to make a bag-like house on a tender leaf. Standing on the leaf, with its little tail turned up, it spins a silken ring around itself, fastening bits of the leaf on the outside, and adding to the lower edge of the ring as they increase it upward,

until it reaches the tail, forming a sort of cone, as at figure 94, *f*. As the caterpillars increase in size they enlarge their houses upward, until the elongation makes their bags so large and heavy they hang to one side, instead of being upright, as at *f*. They are full grown about the end of July when hatched the last of May or early in June. The habit of the full-grown worm of letting itself down by its silken threads, suggested the name of *Drop-worm*. When they travel they extend the head and enough of the body to use three pairs of legs, each provided with a strong claw, while the five pairs of very short legs within their case retain a strong hold with clinging hooks. They moult four times while growing. At each time they close the mouth of the sack, and retire for two days to cast off their skins. In closing the bag, a hole is always left at the end large enough to throw out their excrement and their cast-off skins. The body is cylindrical and soft, and that portion usually concealed in the case is lighter colored. At maturity they fasten their bags securely to the twigs of the tree, instinctively avoiding the leaf-stalk that will fall. Then they line them with soft silk, and turn round, with their heads toward the lower orifice, where they wait to cast their skins and become chrysalids. Up to this change the sexes have been alike in appearance; but henceforth they are easily distinguishable. The male chrysalis has the form of ordinary chrysalids, being about half the size of the female. The female chrysalis has no sign of encased wings, legs, and antennæ, appearing as a naked, yellowish bag of eggs with a ring of soft light brown hair near the tail. After three weeks the male chrysalis works down to the end of his bag, and, hanging half way out, bursts his skin, and emerges as a moth with a black body and glossy wings, as at *d*. The male is proportionally stout bodied, with a long abdomen, and broadly pectinated antennæ. The female has neither wings nor legs. The bag-worm is

exceedingly hardy and vigorous, and readily adapts itself to any food available.

Remedies.—There is no surer method of destroying them than to gather the cocoons as they hang on the trees and burn them. They are easily seen during the winter. This is emphatically applying the ounce of prevention that will save the pound of cure. Two insect friends aid us, both ichneumons. The *Cryptus inquisitor* (Say) is about two-fifths of an inch long. The *Hemiteles thyridopteryx* (Riley) is about one-third of an inch long.

Fig. 95.
CRYPTUS INQUISITOR.

Fig. 96.—*Male.*

Fig. 97.—*Female.*
HEMITELES THYRIDOPTERYX.

Five or six of these sometimes occupy the body of a single bag-worm. After destroying the worm, they spin for themselves, within its cocoon, small white cocoons.

12. The Corn Emperor Moth, the Io Emperor Moth (*Hyperchiria Io*, Linn., *Saturnia Io*, Harris, *Hyperchiria varia*, Walker).—The common name of this moth probably came from its feeding on corn and foraging on both trees and vegetables, a very uncommon habit with insects. It not only feeds on the quince, but a wide range of trees and vegetables. The moth is very beautiful, and only flies at night. The sexes differ both in size and color, the male being the smaller. His color is a deep yellow, with purplish brown markings. His

Fig. 98.—LARVA OF THE CORN EMPEROR MOTH.

one. In its larval state it draws a few leaves together, within which it prepares a place of abode, and in which it winters when about one-third grown. With opening spring it resumes activity, and leaves its case in search of food, and continues to grow till the early part of June, when it shuts itself up in its case, and becomes a reddish brown chrysalis about four-tenths of an inch long. As a larva it was a third longer. As a perfect moth it comes out in about two weeks, with wings expanded to seven-tenths of an inch. The body of the larva is a dull

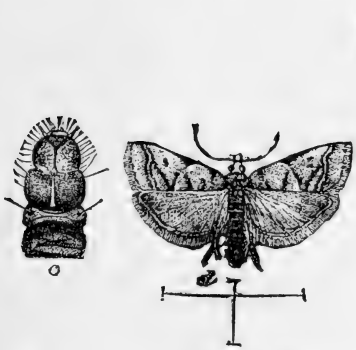


Fig. 114.—*c*, Head of Larva, magnified; *d*, Size of the Moth.

Fig. 115.

THE LEAF-CRUMPLER.

greenish brown, with a horny plate on the top of the first segment, and a flattened dark prominence on each side, below the plate. Each of the other segments is marked by a number of dark dots, each giving rise to a single brown hair. The head is a dark reddish brown. There is only one brood a year, from eggs laid in July. There is a striking contrast between the markings of their two pairs of wings. The fore wings are pale brown, with patches and streaks of silvery white. The hind wings are plain brownish white. The under side of both pairs

is paler. Besides the quince, it feeds on the apple, cherry, plum, and sometimes the peach leaves.

Remedies.—Gather and destroy the cases in which they hibernate. A small Ichneumon fly is a parasite on it; and the two-winged Tachina fly (*Tachina phycitæ*, Le Baron), which closely resembles the common house fly, also preys on it.

ATTACKING THE BUDS.

21. The Tarnished Plant-Bug (*Lygæus lineolaris*, P. Beauv.).—This injurious insect is about one-fifth of an inch long. The males are generally darker than the females, the colors in both varying from a dark brown to a greenish yellow brown. The head is yellowish, with three narrow reddish stripes. The beak is about one-third the length of the body, and is folded under it when not in use to puncture the buds, and suck out their juices. These punctures seem to poison both the buds and young leaves. A whole branch is sometimes seen to wither and die from their injuries. The thorax has a yellow margin, with several yellowish lines running lengthwise. Behind the thorax is a yellow V-like mark, rather indistinct. The legs are yellow and the wings dusky brown. When handled they emit a disagreeable odor. They do their mischief in about three weeks. They lay their eggs on the leaves. The young bugs are wingless, and of a green color. Otherwise they resemble their parents. They are injurious to the quince, pear, apple, plum, cherry, etc.

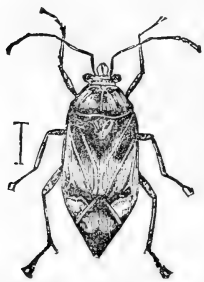


Fig. 116.—TARNISHED PLANT-BUG (*Enlarged*).

Remedies.—They are sluggish, early in the morning, and may then be shaken off and destroyed.

ATTACKING THE FLOWERS.

22. THE PEAR-TREE BLISTER BEETLE (*Pomphopœa œnia*, Say). This beetle is a little over half an inch long, with head and thorax punctated, and a little hairy. The roughened wing cases are marked with two slightly elevated lines. The color is a greenish blue. They eat the entire flower except the stamens. They sometimes eat the tender leaves at the end of the limbs. Besides the quince, they eat the blossoms of the plum, cherry, etc.

The *remedy* is to jar them down early in the morning, and destroy them before the sun warms them to activity.

23. A BEETLE just about the size of the asparagus beetle,

Fig. 117.
PEAR-TREE BLISTER BEETLE.

Fig. 118.
CHRYSOMELIANS.

but with yellow-striped wing-covers like the cucumber beetle, is a Chrysomelian that sometimes riddles the petals of the quince. It eats the buds before the petals have expanded. They feed singly or in groups, and when disturbed, hastily fly away. I first found them on the quince in the spring of 1887.

ATTACKING THE FRUIT.

24. THE CURCULIO (*Conotrachelus Crataegi*, Walsh). —This beetle is an indigenous insect. Its home is the wild haw, from which it has come to be very injurious to the quince. It is a little larger than the plum curculio. The color is ash-gray, mottled with ochre-yellow. It has a dusky, almost triangular spot at

the base of the thorax above. The wing-covers have seven narrow longitudinal elevations, with two rows of dots between them. Its piercer is folded under the thorax when not in use. It feeds on the quince both in the larva and imago, burying itself entirely in the fruit. Occasionally it attacks the pear.

In May the beetles come from the chrysalids, pair, and commence laying their eggs in June. In piercing the fruit they make a cylindrical hole a little larger than the egg, and enlarged at the base. In this the egg is laid, and hatches in a few days. The larva burrows through the growing fruit near the surface, seldom penetrating to the core. At maturity it leaves the fruit through a cylindrical opening, after which it buries itself in the earth two or three inches deep, and remains unchanged till the following May, when it pupates and becomes a beetle.

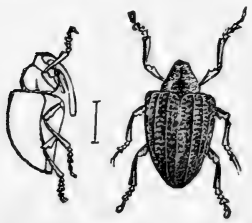


Fig. 119.—QUINCE CURCULIO (*Greatly Enlarged*).

Remedies.—Jarring the beetles off the trees on sheets and killing them, if thoroughly done, will prove effective. Gathering and destroying the fruit that falls, or that which does not fall if it has been stung, will be helpful in destroying them.

There are several caterpillars besides those named that prey on the leaves of the quince, which we have not yet been able to name with certainty. One is a large and nearly black caterpillar; and another is small, and mottled like some of the span worms.

CHAPTER XX.

ADDITIONAL INSECT ENEMIES.

Since the first edition of this work was published several additional insect enemies of the quince have been discovered, or recognized as being more or less injurious to either the fruit or plant; consequently, I have thought best to give a brief description of these, with notes upon their habits, and remedies whenever known.

ATTACKING THE BRANCHES.

XYLOTRECHUS COLONUS.—A small, slender, longhorn beetle, somewhat less than one inch long, and of a light brown color, and large dark patches on the back and wing-covers. Has been found boring in the twigs and larger branches of the quince, but mainly in those that are diseased and dying. This insect usually attacks diseased trees of various kinds; consequently it cannot be considered as especially injurious to the quince. The most practical way of destroying this pest is to cut off and burn all diseased twigs and branches as soon as their condition is observed.

ATTACKING TRUNK AND BRANCHES.

The *Cryptophasa unipunctata*, Don., is a very pretty species of Lepidoptera. Years ago it was observed in the Black Wattle, *Acacia decurrens*, but now is destructive to all trees of the *Rosaceæ*, and includes the plum, apricot, peach, cherry and nectarine.

The full-grown larvæ are about one and one-third inches long; the truncated head tapers in front, with ample mouth-parts for burrowing. The body is in twelve segments, of a dull, pale chocolate brown, except the second, which is pitchy black. The spiracles and

thoracic feet are paler. Along the back, placed transversely, there is a series of double ovate shining spots, which vary in intensity in different individuals. A few short hairs are on all the segments, and most numerous about the head and anal extremity. The caterpillars burrow at right angles to the heartwood, and thence downward twelve to sixteen inches, concealing the entrance to their burrows by caps made of fragments of

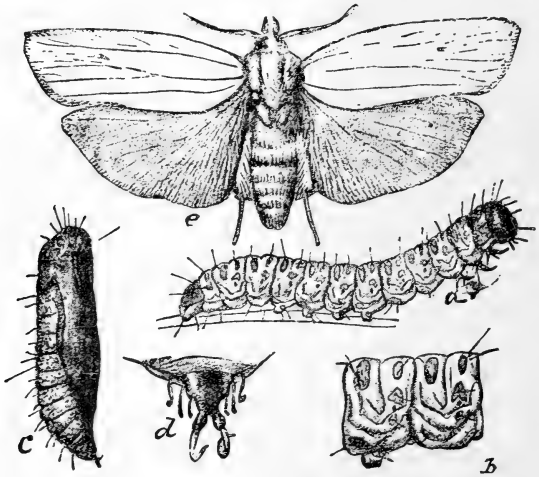


Fig. 120.—CRYPTOPHASA UNIPUNCTATA.

a, Larva; *b*, Lateral view of enlarged segments; *c*, Pupa; *d*, Anal segment or cremaster; *e*, Adult—all natural size except *b* and *d*, which are enlarged.

wood and bark, cemented together so as to resemble a portion of the natural bark. When disturbed in their burrows they move rapidly up or down, and are loath to leave them. They pupate in their burrows near the bark, and the emerging moth, having softened the cover to the entrance, comes out early in the evening and attaches itself to the branches, ready to meet its mate. The moth is exceedingly delicate and easily killed. Its

fine silvery scales rub off easily from its body, which is an inch long. The white fore wings spread two and a half inches. The darker hind wings spread a little over two inches. The antennæ are pectinated, and about half an inch long. Very destructive in Australia.

Remedy.—They are said to be attracted by light in the evening, and when caught may be easily killed.

THE FRUIT-BARK BEETLE (*Scolytus rugulosus*, Ratz.). —Fig. 121 is a very small but destructive beetle, that attacks the plum, pear, peach, apple and quince. Weak and sickly or injured trees are, or have been supposed to be, its choice; but vigorous, healthy trees are destroyed by this pest. It attacks the branches and twigs as well as the trunk. The beetles are very minute, dark brown, cylindrical in their general form, with wing-covers having small punctures between the grooves. The thorax is also punctured. The head is vertical, with short, strong jaws, and antennæ short and strongly clubbed. It is about one-tenth of an inch long, and one-third as wide. The white larva has a small brown head, and is transversely wrinkled, footless, and is as long as the beetle it produces. The adult comes out in May, and fresh burrows are formed as late as October. "The female perforates the bark, and, after pairing in the anterior part of her nearly vertical breeding chamber, burrows longitudinally, laying eggs to the right and left as she progresses. The larvæ eat laterally outward, forming nearly straight channels, furrowing the sapwood more or less, unless the bark be thick, and forming finally a pupal chamber in the wood," from which the matured beetles escape

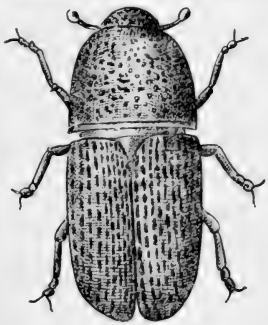


Fig. 121.
SCOLYTUS RUGULOSUS.
(*Enlarged twenty diameters.*)

through the numerous holes seen in the bark, each similar to that by which their mother first entered. Fig. 122 shows perforations of bark, and Fig. 123 a breeding chamber under the bark, both natural size.

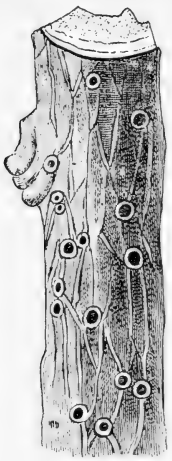


Fig. 122.

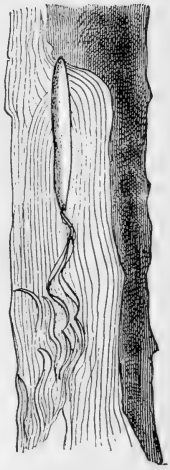


Fig. 123.

Remedies.—If in a vigorous tree, flowing sap may drown the larvæ, hence their supposed preference for weakened trees, and the need of good culture and care. Trees very badly infested should be burned in the winter, when all the insects are in them in the larval state. They have a number of parasitic

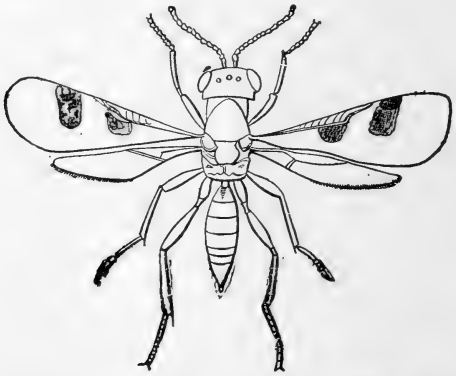


Fig. 124.—PARASITE OF LARVA (*Chiropachys colon*).

enemies, one of which (*Chiropachys colon*, enlarged eight diameters), is shown in Fig. 124, and they are also the

prey of birds that pick off the perforated bark and eat both larvæ and beetles. Washes, both poisonous and offensive, are sometimes applied to the bark as a protection.

ATTACKING THE LEAVES.

THE ROSE BEETLE OR ROSE CHAFER, *Macrodactylus subspinosus*, Fabr., is so named from its fondness for roses, and its annual appearance is with the blooming of the damask rose. The beetle (Fig. 125) is about seven-twentieths of an inch long, with very long legs, pale red, and tipped with black feet. The body is covered with a short ash-colored down. It suddenly appears about the time when grapevines bloom, and is active from thirty to forty days, swarming upon its choice of plants, which vary somewhat in different years. Partial to flowers, it also feeds on leaves of a wide variety of trees, and choice fruits. The female beetle deposits about thirty eggs an inch or two below the surface of the earth; these hatch in about twenty days. The larva is a white grub, which feeds on roots till autumn, when it goes below frost, returning in the spring to pupate in May near the surface of the ground, thus completing its life circle in a year.

Fig. 125. ROSE BEETLE.

Remedies.—Prof. Riley found *Elateridæ* larvæ destroyed the rose beetle larvæ. They are not affected by the arsenical poisons used for other pests, but yield to carbolic acid, one gallon to one hundred gallons of water, sprayed on plants they eat; and to scalding water and kerosene. Dusting with air-slaked lime, or spraying with lime water, a peck to the barrel, is also recommended.

TENT CATERPILLAR (*Clisiocampa Americana*, Har.). —The moth is an inch and a half across the wings, which are ashy brown or a pale brick color, marked by two light lines obliquely across the fore wings. Their

general color is a reddish-yellow brown intermingled with gray. The female is larger and lighter colored, with antennæ more slightly pectinated than the male. They fly at night in June and July, and lay their eggs on small twigs. Their first choice is the wild cherry, and next the apple, but they feed on the peach, quince, plum, and quite a number of other trees.

The full-grown larvæ are about two inches long. As they grow they enlarge the tent, and moult four times. At maturity they scatter, and often go a long distance before spinning the cocoon, in which they pupate in from seventeen to twenty days.

Remedies.—Tachina flies and ichneumons are their parasites. The Baltimore oriole and the cuckoo eat them by piercing the tent, leaving their empty skins. A spray of any arsenical poison on the foliage will be effective. The eggs are easily seen by looking over the infested trees any time after the leaves fall, and are often in easy reach. Early in the morning and late in the day most of the caterpillars are in the tent, and then can be easily destroyed.

The Tingis (*Corythuca arcuata*).—A small bug with the thorax and wings spread out leaf-like; the fore-legs are simple, and the beak reaches to the end of the breast. It sucks the juice of the leaves of the quince and other kinds of trees, sometimes occurring in sufficient numbers to check their growth. "It winters in the adult stage, hiding wherever it can find a chance, and makes its appearance in spring quite late, and in small numbers. It lays its eggs upon the leaves in clusters, and from these hatch the wingless bugs, which feed in company until well grown. Late in summer they reach their full growth, scatter about, and finally hibernate."

Remedy.—Spray with kerosene emulsion; in autumn burn accumulated leaves and rubbish that furnish winter quarters.

GIPSY MOTH (*Ocneria dispar*, Linn.).—This is a European insect, introduced by L. Trouvelot of Massachusetts about 1870, for the purpose of experimenting in cross-breeding with silk worms. The experiment was a failure. The insects escaped from him, and their progeny has become widely distributed in Massachusetts, but as yet not elsewhere. It is destructive to almost every kind of tree and shrub.

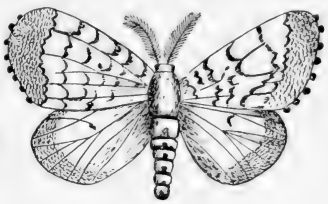


Fig. 126.—MALE GIPSY MOTH.

The male moth (Fig. 126) measures about an inch and seven-eighths from tip to tip across the fore wings, which are dark yellow-brown, with black wavy lines across them. The hind wings are an inch and a quarter across, and marked with dark lines radiating out from the body, and dividing as they spread. The outer edge of all the wings is dotted with a row of black spots. The antennæ are broadly pectinated. The female moth (Fig. 127) measures two and three-fourths inches across the wings, and is marked much like the male on a very light ground. The hind wings are two and one-eighth inches across, very light, and otherwise like the male. The antennæ are thread-like, curving towards each other at their tips.

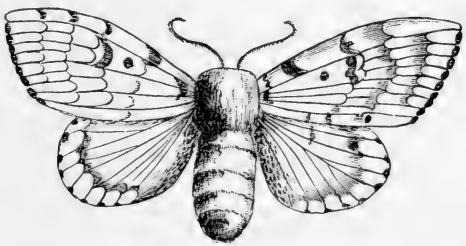


Fig. 127. FEMALE GIPSY MOTH.

A full-grown caterpillar of this moth is shown in Fig. 128, and a pupa in Fig. 129.

Remedies of various kinds have been tried and are still in use, but the most effectual thus far has been the gathering of the larvæ and cocoons by hand, although spraying with poison solutions, and especially one made with arsenate of lead, has proved to be of considerable value.

The larva of an insect resembling that of the corn-ear worm (*Heliothis armigera*), which pupates in the ground, did great damage to the leaves of quince and apple trees in June and July,

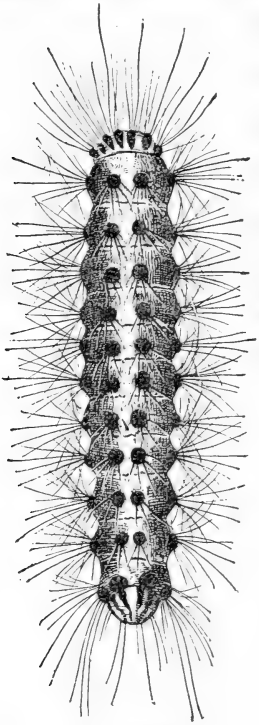


Fig. 128.

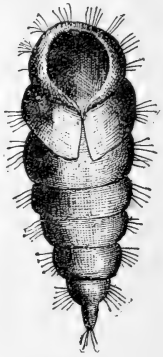


Fig. 129.

1891, on the grounds of H. S. Buck of Coeur d' Alene City, Idaho. This insect has not, as yet, been identified by entomologists.

INSECTS GENERALLY DESTRUCTIVE.

San Jose Scale (*Aspidiotus perniciosus*. Comstock).—This species of bark louse received its common name

from San Jose, California, where it was first discovered in this country, and its specific scientific name is fully deserved because it is one of the most pernicious pests of fruit trees generally that has appeared in the present century. It was first seen in California about 1870, and since that time became widely distributed on nursery stock, also on fruits and on the bodies of larger insects, birds, and by various other means. It infests the bark, twigs, leaves and fruit of the quince and other trees. At first the young are inconspicuous, but they rapidly increase in size and numbers, till the bark is incrusted with scales, presenting a grayish appearance as if the trees were coated with lime, or ashes. In spring the young appear crawling from under the scales, and through the summer there is a constant succession of generations. The young are active and spread rapidly, until each female becomes fixed and begins to secrete a scale, and when full grown casts off her legs and antennæ, and there receives the visits of the male, an active two-winged insect. It

Fig. 130. LIMB INFESTED WITH SCALE.

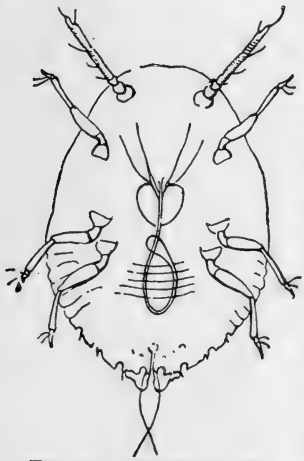


Fig. 131. UNDERSIDE OF A YOUNG LARVA.

differs from the oyster-shell bark louse by being nearly round, or slightly elongated and irregular. It is flat, and when fully grown about one-eighth of an inch across. The middle of each scale is marked with a black or yellowish point slightly elongated. When crushed a yellowish, oily liquid appears on the bark, often changed to a purplish color. Young scales are darker than when older and larger, and look black, while those still younger are yellowish. A section of pear stem is shown in Fig. 130, covered with the San Jose

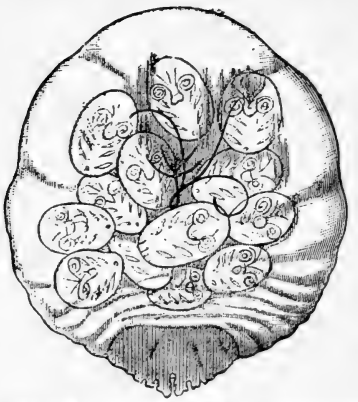


Fig. 132. ADULT FEMALE CONTAINING YOUNG.

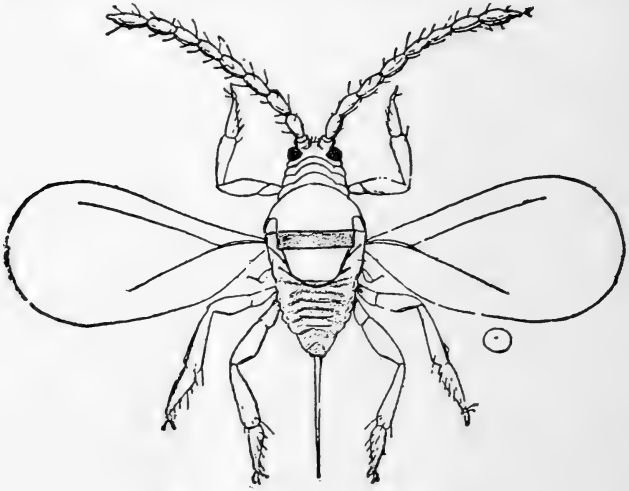


Fig. 133. ADULT MALE INSECT.

scale, natural size, while at Fig. 131 the underside of a young larva, and at Fig. 132 an adult female, both of the latter greatly enlarged, also a winged male at Fig. 133.

Remedies.—Badly infested trees should be burned. Insecticide washes and sprays may be used on trees less infested. Spraying with kerosene-and-soap emulsion is highly recommended. Trees thoroughly washed in winter with a saturated solution of potash, and in summer drenched with kerosene emulsion, will be well protected from all sorts of scale insects. Its natural enemies are the *Aphelinus fuscipennis*, a very minute, yellowish parasitic wasp, a foe to all scale insects. Two species of lady-birds also feed on this scale. The "Twice-stabbed" lady-bird, *Chilocorus bivulnerus*, a black, hemispherical beetle an eighth of an inch long, with a red spot in the middle of each wing-cover. The other is *Pentilia misella*, a minute black insect, scarcely as large as the scale it devours.

ATTACKING THE FRUIT BUDS.

A very small scarabeid beetle, the *Valgus canaliculatus*, spends its larval stage in rotten wood. It is numerous enough some years to do considerable damage, eating out the fruit buds when they are small. A spray of arsenical poisons is all that is needed to destroy them.

ATTACKING BOTH BUDS AND LEAVES.

THE EYE-SPOTTED BUD MOTH (*Tmetocera ocellana*) is closely allied to the codlin moth, which it resembles in size and form. Its generic name is from the Greek word, signifying cut-horned, the base of the antennæ of the male having a notched appearance. The specific name is *ocellana*, from the Latin for eye-like, because of the eye-like appearance of a spot on each front wing. It was common in Europe over a century ago, and is now widely distributed in America. It has borne differ-

ent names and classifications in the past, but all are synonomous with that here given. Dr. Harris called it the eye-spotted Penthina, and said: "It is difficult at first to conceive how such insignificant creatures can occasion so much mischief as they are found to do. This seems to arise from the number of the insects and

Fig. 134. BUD MOTH, TWICE NATURAL SIZE.

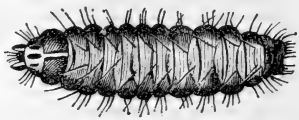


Fig. 135. LARVA, THREE TIMES NATURAL SIZE.

their mode of attack, whereby the opening foliage is checked in its growth or nipped in the bud." The fore wings expand about three-fifths of an inch, with leaf-like venation (Fig. 134). The head, thorax, and both the inner and outer parts of the fore wings are dark ashen gray; their middle portion is cream white, streaked with gray. The under-side is darker, with light costal streaks on the outer part. There are streaks of lead-blue in their markings. The hind wings are ashy gray. In June and July the moth lays her eggs upon the leaves, where they hatch and feed under the protection of silken tubes which they spin, drawing the edges of the leaves about them. When about half grown, the larva, having moulted three times, leaves its tube and leaf to seek a place for hibernation in a silken cell which it makes in any angular roughness of the bark near a bud. If the bark has no angular place the larva cuts one to fit it, weaves its silken covering, disguised by particles of bark and dirt. Now it is about a quarter of an inch long. With the

Fig. 136.

Fig. 137.

fore wings are marked with a zigzag line near the base, and two oblique wavy lines near the outer margin, with other spots on the middle forming the letters A, H, all of a purplish red color. The hind wings are hairy, and

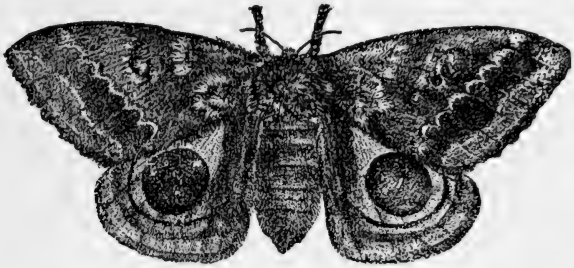


Fig. 99.—CORN EMPEROR MOTH, FEMALE.

purplish red next to the body, with a narrow curved band of like color near their posterior margin, and within this band there is a curved black line. On the middle of the wing is a black spot with a bluish center, on which there is a silver-white line. The upper side is ochre-yellow; the head and thorax purplish brown. The antennæ are broadly pectinated, while in the female they

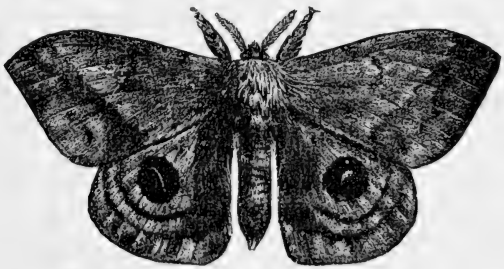


Fig. 100.—CORN EMPEROR MOTH, MALE.

are feathered very narrow. The anterior wings of the female are purplish brown, or a faded cream color. The zigzag and wavy lines across them are gray, and marked in the middle with a brown spot, surrounded by an irregular

gray line, and towards the base are covered with a thick wool-like covering. The posterior wings resemble those of the male, as do also the head and thorax. The expanse of the wings is from two and three-quarter inches to three inches and a half.

Soon after pairing the female lays her eggs in clusters of twenty to thirty. The eggs are top-shaped, flattened at the top and compressed on the sides; about one-twentieth of an inch in diameter, and creamy white, with a yellowish spot above, which gradually increases in color as they come to maturity, when it is almost black, and the yellow larva show through the sides. Beginning their work as early as June and extending it nearly through September, it is easy to see that they may do great harm. The broods remain together till near maturity, when they separate for pupating. The full-grown caterpillar is two and a half inches long, pea-green, with a broad brown stripe, edged white, low down on the body. Beginning with the fourth ring, there is a brown triangular spot on the under side of each. The breathing pores are yellow, ringed with brown. Each segment of the body is dotted with little warts, armed with clusters of branching spines. The prick of these sharp spines irritates the skin like the sting of nettles. Up to the age when they separate, the groups move in a regular order, guided by the thread spun by the leader. They moult four times, attaining maturity in August and September, according to the time they were hatched, when the caterpillar will measure two and a half inches in length. The full-grown larva descends to the ground, where it draws together leaves or any other convenient material for an outer covering, within which it makes a cocoon of tough, gummy, brown silk, in which it changes to a chrysalis.

Remedies.—If not discovered before they are half grown, when together, they can be readily found and

destroyed after they separate, by their large droppings. The larvæ are attacked by two parasites; one a very small, unnamed, four-winged fly, the other the Long-tailed Ophion (*Ophion macrurum*, Linn.).

13. The Vaporer Moth, the White-marked Tussock Moth (*Orgyia leucostigma*, Smith and Abbr.).—This moth takes the name *Orgyia* from a word signifying

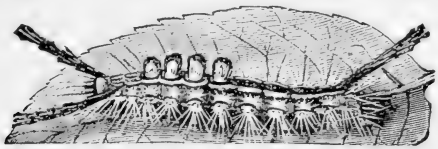


Fig. 101.—LARVA OF WHITE-MARKED TUSSOCK MOTH.

to stretch out the hands, on account of its resting with the fore legs extended. The English name, Vapor Moth, is applied as descriptive of the males ostentatiously flying by day, or vaporing, when most other moths keep concealed. The name White-marked Tussock Moth is applied as descriptive of the four little hairy tufts on the

Fig. 102.—*Pupa.*

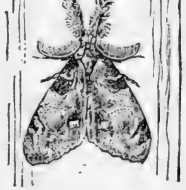


Fig. 103.—*Male.*

WHITE-MARKED TUSSOCK MOTH.

back of the caterpillar. On each side is a row of smaller tufts of fine, yellow hairs. A narrow dark stripe runs along the back, and a wider dusky stripe runs along each side. There are two long black plumes on the first ring and one on the top of the eleventh ring. They are

something over an inch long at maturity. The body is bright yellow, and the head coral red. Though not gregarious, they are often numerous enough to be very destructive to the foliage of the quince and other trees and shrubs. There are two broods in a year. The first hatch about the middle of May, and the second late in July. The first brood complete their growth by the middle of July, spin their cocoons on the leaves or branches of trees, and enter into the chrysalis state. The chrysalis has little downy hairs, and three oval clusters of bran-like scales on the back. They pupate eleven days, when the female comes forth wingless, and the male with wings that expand an inch and three-eighths. The wings are ashen gray, crossed by darker wavy bands on the upper pair, which are also marked by a black spot near the tip, and a very small white crescent by the outer angle. Their antennæ are broadly pectinated. The body of the female is a very thick, oblong oval, in distinctly marked sections, and of a lighter gray than the male. She waits on the outside of her cocoon for the coming of the male, and after meeting him lays her eggs in an irregular mass on the top of the cocoon, which is spun between the leaves, and then covers them with a frothy looking substance, which hardens to brittleness, and is then impervious to water. After laying her eggs she drops to the ground and dies. The young larvæ, when seriously disturbed, let themselves down by silken threads; and when the danger seems past they climb up the threads to regain their former situation.

Remedies.—The leaves attached to the cocoon show where their eggs are laid, so they can easily be found during the winter, and destroyed. There are nine species of two and four winged flies that are known to be parasites of this insect in the larval state.

14. Pear-tree Slug (*Selandria* [*Blennocampa*] *Cerasi*, Peck).—This caterpillar is called a slug, from its

appearance in the larva state. The name *Blennocampa* signifies a slimy caterpillar. Its favorite trees are the pear, cherry, and quince, and it is sometimes found on the plum and mountain ash. Ordinarily there are but few on a leaf, but sometimes the leaves are fairly spotted with them. Thirty have been counted on a single leaf. Professor Peck, of Massachusetts, wrote its natural history in 1790 with such critical accuracy that little has been since added to our knowledge of its life history. It is now quite generally spread over the country. This slug comes from the eggs of a saw-fly, about one-fifth of an inch long, resembling the common house-fly. Its body is glossy black. The first two pairs of legs are clay-

Fig. 104.—*Female.*

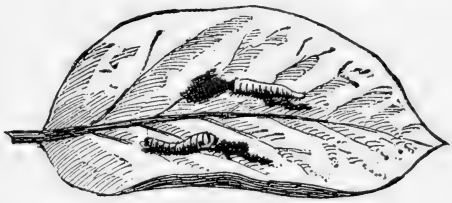


Fig. 105.—*Larva.*

PEAR-TREE SLUG.

colored, with dark thighs. The hind legs are dull black with clay-colored knees. The wings are transparent, slightly convex, and uneven on the upper side, with brownish veins. They reflect the changeable colors of the rainbow, with a smoky tinge in a band across the middle of the first pair.

The female is provided with a saw-like appendage, with which she cuts a curved incision through the skin of the leaf, in which she lays her eggs singly, and generally on the under side, from about the middle of May into June. In fourteen days they begin to hatch. At first the slugs are white; but soon a slimy matter oozes through the skin, and covers their backs and sides with an olive-colored, sticky coat. The head is small, of a dark

chestnut color, and is entirely concealed under the body, which tapers almost to a point at the tail, which in repose is turned up a little. They have twenty very short legs, a pair under each segment, except the fourth and the last. They grow for twenty-six days, casting their skins five times, and eating them every time till the last. After the last moult they show a clean yellow skin, free from viscidity. They now show the head and segments of the body very plainly, and are about half an inch long. In a few hours after this last moult, they leave the tree and burrow a few inches in the ground, where they form little oblong-oval cavities, lined with a sticky, glossy substance. In these cells they pupate; and in sixteen days the change is complete from the worm to the fly, which bursts the cell and crawls out to seek its mate.

The flies of the first brood lay eggs for a second in July and August, and the second brood go into the ground in September and October, where they remain till the next spring, when they in turn change to flies. Where they are very abundant the foliage is entirely destroyed, and before the trees can again clothe themselves with leaves, it is too late to perfect fruit buds, and barrenness must follow. If they are allowed to continue their work year after year, the trees not only become barren, but die.

Remedies.—We may catch the flies if we see them laying their eggs, for they are not very shy. Saunders says, if the tree is shaken while they are at work, "they fall to the ground, where, folding their antennæ under their bodies and bending the head forward and under, they remain for a time motionless."

Powdered hellebore in water, an ounce to two gallons, or either of the poisons, white arsenic, London purple, or Paris green, a teaspoonful to two gallons of water, or air-slacked lime, or ashes, or any dry dust, or slug-shot, sprayed or dusted on the leaves, all seem to be effective.

I have found the dry earth under the trees all-sufficient, if applied before they are ready to go into the ground, and the poisons may therefore be avoided.

A very minute ichneumon fly, a species of *Encyrtus*, deposits an egg in the egg of the saw-fly; and from this tiny egg a maggot is hatched, which lives on the egg of the slug-fly, and when it has consumed it, becomes a chrysalis, and then a fly. Prof. Peck found that many eggs of the second brood were destroyed by "this atom of existence." The Vireo and Cat-bird eat them from the leaves. In dusting tall trees a sieve fastened on the end of a pole is a convenient implement. An old tin can well punctured with holes is a very cheap sieve for the purpose.

15. The Polyphemus Moth (*Telea Polyphemus*, Sim; *Attacus Polyphemus*, Harris). It is called *Polyphemus* after one of the giants in mythology bearing this name. It is one of the largest of the native American silk worms, belonging to the genus *Attacus*. The wings of the female spread fully six inches; those of the male a little less. It is of a dull ochre-yellow color, clouded with black in the middle of the wings. On each of the fore wings, near the center, there is an eye-like spot transparent in the center, crossed by light lines, and surrounded by rings of white, red, yellow, and black. Before the eye-spots of the hind wings are large blue spots, shading into black. On the front margin of the fore wings there is a gray stripe, which crosses the fore part of the thorax, and near the base of these wings are two short red lines, edged with white. At their tips are also two small dark spots. The hind wings are cut off almost square at the corners, and near their margins have wavy lines like those on the fore wings. The antennæ of the males are very broadly pectinated; of the females, lightly feathered. The combinations of form, color, and markings make them very beautiful.

Finding the larvæ every year on some of my quince trees, I have studied their habits with a great deal of interest. So far as I know, I am the first to prove that

Fig. 106—THE POLYPHEMUS MOTH, FEMALE.

they have two broods a year. Packard is certainly mistaken when he speaks of "our native species bearing but a single crop of worms," for this one is double-brooded. The chrysalis that winters in the cocoon is proportionately short and thick, of a reddish brown, and distinctly

Fig. 107.—THE POLYPHEMUS MOTH, MALE.

marked in cylindrical rings. The larvæ of the first brood only pupate about twenty days, spinning their cocoons in June and July, according to the time they were

hatched; for the cocoons that winter, vary considerably in the time of bringing out their moths. They generally come out late in May and on into June. Then they lay their eggs, usually singly, on the under side of leaves, each moth laying several hundred, which hatch into caterpillars in ten or twelve days. The eggs are one-tenth of an inch across, much flattened, and of a color approaching to white. At first the abdomen of the female is so heavy with the abundance of the eggs that she flies only short distances.

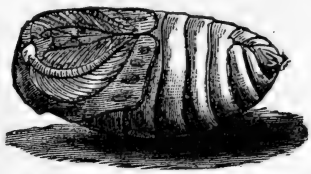


Fig. 108.—CHRYSALIS OF POLYPHEMUS MOTH.

The caterpillar is a shade of green so near like the leaves around it, one often has some difficulty in discovering it, even after he has found where to look by its

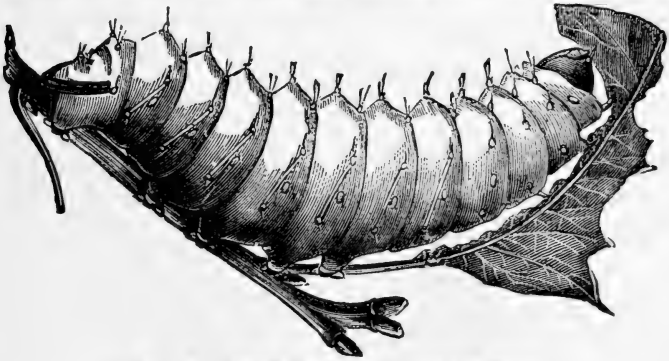


Fig. 109.—WORM OF THE POLYPHEMUS MOTH.

large droppings, and also because of its habit in repose of clinging to the under side of the twig with the back down; and the length of the body is so greatly contracted as to hunch up the segments. It has twelve large segments, each nearly as thick as a man's finger when the body is shortened to two inches; but when ex-

tended to three inches, as it often is in traveling, the thickness is greatly reduced.

The worm moults four times, at intervals of ten days, and then a fifth time after twenty days. Soon after the last moult it draws a few leaves together, within which it spins a short, thick cocoon of pure silk. In confinement I have found it spins enough of its cocoon in a single night to entirely hide itself; but it evidently continues to spin much longer on the inside, as its motions indicate. Like all its congeners, it spins a double thread from its mouth, gumming it enough to make it strongly adhesive, not only to all points of attachment, but to all parallel and intersecting threads. When finished it is

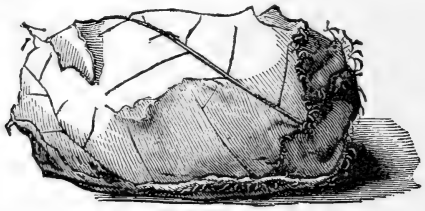


Fig. 110.—COCOON OF THE POLYPHEMUS MOTH.

water-proof. It pupates soon after the cocoon is complete, and in about twenty days the moths of the first brood appear.

The twelve segments of the larva are each marked with three side rows of very bright yellow spots. The seven segments in front of the posterior also have a very bright line or bar, slightly inclined forward, and reaching from the dot of the upper row to that of the lower row, and passing the dot of the middle row. On the back is a row of small hairy elevations, one on the top of each segment. The head is pale brown, the spiracles pale orange, and the V-shaped band around the tail is a purplish brown. The feet of the first three segments are sharp claws; the next two segments are foot-

less, followed by four with very strong powers of attachment; then two more are footless. The terminal segment has pale brown feet.

They feed on the oak and elm as well as the quince. Harris was mistaken in saying that the "outer covering of leaves which fall off in the autumn bear the enclosed tough oval cocoons to the ground." I have always found those on the quince fastened securely around the stem, so as to avoid the danger of falling to the ground. The second brood spin their cocoons in August and September, and these furnish the winter quarters for the chrysalids.

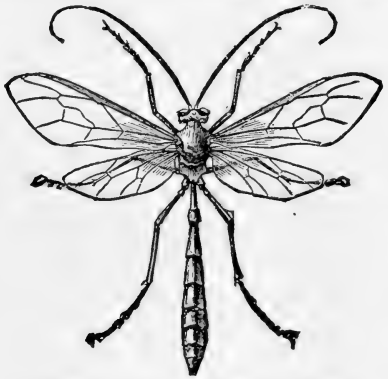


Fig. 111.—LONG-TAILED OPHION.

As soon as they are out of the cocoon the limp wings unfold, and they crawl to some place where they can hang and dry, all which takes place in an hour, when they can fly.

Remedies.—At the annual pruning, such cocoons as have escaped previous gathering should be looked for and destroyed. During the summer and fall, the larvæ may be subdued by hand picking, the place of their location being found by their large droppings. Insectivorous birds and poultry feed on them. It is estimated that four out of five of the larvæ of this moth are destroyed

by its parasitic enemies. The largest, and perhaps the commonest, is the Long-tailed Ophion (*Ophion macrurum*, Linn.). It is a large yellowish brown ichneumon, that lays its eggs on the skin of the larvæ, to which they adhere by the gum surrounding them, and hatch in a few days. A two-winged tachina fly is also often found as a parasite on this caterpillar. Its larva is a fleshy and footless grub, of a translucent yellow, and about half an inch long.

16. Cotton Tuft (*Lagoa crispata*, Packard).—This is a very singular variety of the caterpillar family, which derives its name from the crinkled, woolly hairs on the fore wings of the parent moth. The thorax and lower part of the sides are a slate-colored, dusky orange. It makes its cocoon by interweaving its long hairs with its silk. The cocoon is long, cylindrical, and dense. The skin of the very thin pupa is found protruding from the cocoon after the moth has escaped. When I first saw the Lagoas on the quince trees, the caterpillars were about a third of an inch long and looked like so many tufts of white cotton. Hence the common name I have given it. After they had moulted, and grown to about three-quarters of an inch in length, they appeared less hairy, the back being wide in proportion to the length, with the corrugated parts conjoined, reminding one of a trilobite.

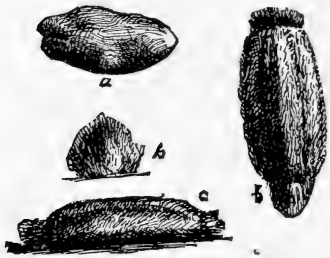


Fig. 112.—COTTON TUFT.
a, cocoon natural size; *b*, early appearance; *c*, advanced growth; *d*, matured larvæ.

17. The Apple-tree Aphis (*Aphis mali*, Fabr.; *Aphis malifoliæ*, Fitch). The name *Aphis* means to exhaust, and is well applied to this little insect, which proves itself a great exhauster of vitality on all trees on which it lives. They have small heads, armed with

three-jointed beaks, which puncture the tender foliage, and through which they suck out the juices of plants. Their eyes are round, without eyelets. Their antennæ are long and tapering. Their legs are long and slender. There are but two joints to their feet. Their wings are nearly triangular, and the upper wings, longer than the body, are nearly twice as large as the lower. In repose these wings cover the body like a steep roof.

The most wonderful thing about them is the way they multiply. The males die soon after they pair in autumn. The females lay their eggs on the bark near the leaf buds, and then die. In spring, when the leaves begin to grow, the eggs hatch and they begin their depredations. All

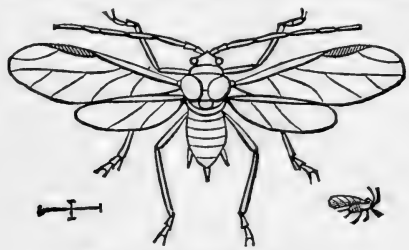


Fig. 113.—THE GREEN APHIS.

the young lice are wingless females. In ten or twelve days they attain to maturity, and by a viviparous generation they begin to give birth to a daily increase of about twenty. This second generation are also wingless females, and soon multiply by the same process as did the first. Thus they multiply throughout the season, without the appearance of a single male, till in autumn they produce a brood of both sexes, as well as the viviparous form already described. During the summer, some of the females acquire wings, and, dispersing to other trees, found new colonies. They are generally wingless, but when winged, look like the males, with a black head, thorax, and antennæ, black dots in a row along each

side, black nectaries and tail appendage. The neck is green, the body is yellowish green, striped often with a deeper green. The young are almost white. The wings are transparent, with dark veins.

When they become gorged with sap, the excess is thrown out through two little tubes, which project, one on each side, from the anterior part of the body. These are their nectaries, through which they eject a honeyed fluid known as honey dew. To feed on this, a variety of ants and flies will be found to visit them. The ants, with whom they live on friendly terms, stroke the aphides with their antennæ to induce them sooner to void this sweet liquid, which they hastily devour.

Experiment has shown them capable of producing eleven generations in seven months, when frost closed the opportunity. In a heated room they continued to reproduce a constant succession, without the intervention of males, for four years. Even then there was nothing to show why it might not have been continued still longer. Dr. Burnett considers this anomalous mode of increase as a process of *budding*, and that the whole series, like the leaves of a tree, constitute only one generation, resulting from the previous union of the sexes. Réaumur proved *one* capable of increasing to six thousand millions in five generations. The leaves of trees infested with aphides soon become distorted, or curled back so as to have their tips touch the twig whence they sprung, thus protecting them from the sun and rain.

Remedies.—The eggs can be destroyed by a wash of caustic lime or soda. The young may be destroyed by alkaline solutions, and by tobacco water, made by boiling a pound of stems in a gallon of water. Twigs can be bent into it with but little waste of the solution. Small birds in winter hunt over the trees for its eggs, and in summer for the lice. The *Ichneumon fly* deposits her egg in the aphis, and this soon produces a destroyer.

The *Aphis-lions* and the *Lace-winged flies* produce larvæ which destroy them in abundance. Myriads of aphides are destroyed by Lady-birds and their larvæ. There are nearly a hundred species of *Lady-birds*, all of which are our helpers. I have found the large black ant of great service. They concentrate on limbs infested with lice, and clean them off. I count each nest of ants worth a dollar a year as insecticides.

The Syrphus flies (*Syrphus politus*, Say) lay one egg in a group of plant lice, which hatches out a footless, eyeless, flattened, wrinkled, green and purple maggot. Their bodies are supple, and their mouths are provided with a triple-pointed dart, with which they pierce the aphides, and suck them dry.

A black aphis appears some years in considerable numbers on my quince cuttings, just in time to destroy opening buds. Later I have found it in large numbers on the young shoots of growing trees. I have not yet determined with certainty its position in the aphis family.

18. Katy-did, the Broad-winged Katy-did (*Cyrtophyllus concavus*, Say; *Platyphyllum concavum*, Harris). —*Platyphyllum* means a broad wing, and is used to distinguish this from the Southern Katy-did, which belongs to the genus *Phylloptera*. It is a green grasshopper of the order *Orthoptera*, and derives its common name from the note of the male, which is produced by a kind of taboret. The triangular overlapping part of each wing-cover forms a strong half-oval frame, in which a thin, transparent membrane is stretched. The friction of the taboret frames against each other when the wing-covers are opened and shut, produces several distinct notes closely resembling articulate sounds, and corresponding with the number of times the wing-covers are opened and shut. In the stillness of the night these notes may be heard a long distance, as rival notes answer from adjacent

trees with emphatic assurance "Katy did, she did." These notes are continued all night.

The body is pale green; the wings and wing-covers are of a deeper shade. The legs are also green, and very long. The thorax is rough, marked by two slightly transverse furrows; and being curved down a little on each side, with a slightly rounded elevation behind, somewhat resembles a saddle. The insect is about an inch and a half long, the female having a projecting ovipositor. The wings are shorter than the wing-covers, which, with their strong midrib and regular venation, much resemble a leaf. These large wing-covers are both oval and concave, and inclose the body within, meeting above and below at their edges like the two parts of a bivalve shell. The piercer of the female is broad, laterally compressed, and curved like a cimeter; and in both sexes there are two little thorn-like projections from the middle of the breast between the fore legs. The antennæ are very long and slender. They attain maturity in September and October, when the female lays her eggs in two intersecting rows of eight or ten each, along the twig of the tree, the bark being roughened under them. The eggs are slate-brown, about one-eighth of an inch across, shaped much like flax-seed, and overlap each other like shingles. They are gummed securely to the twig. They hatch in the spring.

Remedy.—Gather the broods of eggs on the twigs at the annual pruning; or capture and destroy the mother before she deposits her eggs. They are often found on grapevines, both eggs and insects.

19. The Oblong-winged Katy-did (*Phylloptera oblongifolia*, De Geer) is so similar in habits of feeding and laying its eggs as not to need any separate description.

20. The Leaf-Crumpler (*Phycis indigenella*, Zeller).—The common name of this insect is a very appropriate

opening spring the little brown larvæ leave their winter quarters, resuming their destructive work, first in the buds, and later upon the leaves. They are full grown in June and July and then about half an inch long (Fig. 135), and pupate ten days in a silken tube or cocoon among the leaves they have killed. Fig. 136 presents a ventral view, and Fig. 137 a dorsal view of a pupa, twice natural size. When the moths emerge they keep very quiet through the day with their wings folded roof-like over the body, looking like the bark of the tree. At night they pair, and lay their eggs singly or in clusters of two to seven. The larval period extends over a part of two years, but they are single brooded.

Remedies.—In Europe five species of parasites, and in the United States three others, prey upon this pest. Besides these, the large mudwasp, *Odynerus Catskillensis*, paralyzes this and other like larvæ, and puts them in cells of mud as food for its own young in its larval stage. Birds also destroy them. Hand-picking has been tried, but is impracticable on a large scale. But for the protection of their webs we could destroy them with kerosene emulsion. Paris green at the rate of a pound to one hundred and fifty gallons of water may be combined with Bordeaux mixture as a fungicide, and accomplish a double protection. This treatment will be most effective if applied when buds and leaves are expanding, as then it eats part of a bud or leaf in one place, or the side of a flower in another, so as to do the most damage. Dr. Riley recommended burning fallen leaves in autumn, and this is advisable in all orchards and gardens for the destruction of hibernating insects and many fungous diseases.

ATTACKING THE FRUIT.

The Apple Worm or Codlin Moth (*Carpocapsa pomonella*, Linn.), was brought to America about 1800,

and has spread widely. It adds the quince and pear to its bill of fare. It is double-brooded, and very injurious. The moth lays her eggs singly on the blossom end of the fruit, where it hatches in a few days, and burrows for the core, feeding as it goes. In three or four weeks it is full grown, and crawls out of the fruit to seek a place to spin its cocoon and pupate, coming out with wings in ten to fifteen days later. The second broods do not issue as moths till the next spring.

Remedies.—Spraying the trees with any of the arsenical poisons when the fruit is small, is most relied on to destroy the larvæ before they get into it. Those that escape and mature in fallen fruit are trapped with bands placed around the trees. Where there are plenty of apples, other fruits are little sought; but in western New York, where quinces are largely grown, the codlin moth is a very serious enemy.

CHAPTER XXI.

SOME FUNGI INJURIOUS TO THE QUINCE.

BY DR. BYRON D. HALSTED.

In this chapter the reader's attention is called to a group of enemies of the quince that consist of minute plants. Fungi are usually so small that they can only be seen with the microscope, and consist of fine threads which run into the substance of the quince stem, leaf or fruit, and rob it of its vital juices. The spores they produce are minute bodies, capable of growing into new fungi when conditions are favorable. Spores serve the same purpose for fungi that seeds do for higher plants.

The orchardist's attention is called to those kinds of fungi that have proved to be the most destructive to quinces, leaving out of sight a large number that occur

infrequently, as a rule, and without serious results. It might be said in passing, that the quince, including its foliage, branches and roots, has no less than ninety-six kinds of fungi upon it. Some of these that prey to a disastrous extent upon the fruits are also found upon the leaves, causing them to blight and fall away. This is a matter of considerable importance when the question of remedies is taken up later.

The fungi treated in the following pages are arranged somewhat in the order of their appearance in the orchard, and not as to their ultimate injurious effects. Many of the engravings are from photographs of the specimens, and, of course, all color and something of the other characteristics are necessarily lost. However, it is hoped the reader may be able, by their aid, to fully understand the text, and obtain through both an insight into the nature of these troubles.

THE QUINCE RUST (*Ræstelia aurantiaca*, Pk.).—The first fungus to make its appearance upon the quince fruit in early summer is the rust. While the fruit is quite small the fine threads of the rust plant grow through it, and in one or more places the green color is replaced by orange, the quince at the same time usually becoming distorted. In the orange patches small pimples appear, which continue to enlarge, and from them short horns project and soon become ruptured at the top. Within these horns or tubes the bright orange spores are borne in great abundance and readily fall out. Four young quinces thus ruined by the *Ræstelia* are shown in Fig. 138, and the horns or spore-bearing tubes may be seen projecting from the surface of the young fruits. As time passes, the affected fruit, failing to grow or enlarging but slowly, becomes hard by drying, and either falls to the ground or remains upon the trees as a worthless and unsightly product until the close of the season.

This rust of the quince is a form of fungus that lives during a part of its development on the two kinds of juniper, namely: the red cedar and the low juniper, and is recognized upon the stems by the swollen nodules and the reddish color.

To repeat, the fungus known as *Gymnosporangium clavipes*, C. & P., one of the kinds of cedar galls, is a

Fig. 138. YOUNG QUINCES AFFECTED WITH RUST.

form of the rust (*Ræstelia aurantiaca*, Pk.) that attacks and injures the quinces. This rust stage also grows upon apples, hawthorns, and the Juneberry, or shad bush, as it is sometimes called. It is often quite abun-

dant upon the hawthorn fruit, but it is only when upon the quince that it becomes of special interest to the fruit-growers.

It is important to know that the rust grows on the juniper in one of its forms. If the spores from the juniper galls were prevented from going to the quince, the trouble in the orchard would soon be at an end. Again, if it were only between the junipers and the quinces the case would be simpler; but as it is, there are the Juneberry and the hawthorns which serve as breeders of the troublesome parasite in the hedgerow and wood lot.

The rusts (and there are hundreds of kinds upon as many different species of plants) are not subdued by spraying with fungicides; at least, this defensive art has not been successfully practiced with them. They are deep-seated, gross-feeding fungi, and have done the larger part of their harmful work before their presence is manifest. Properly timed, there is but little doubt that spraying would check germination of the spores as they come from the cedar galls, borne by the early spring breezes. But knowing that the quince rust is associated with the galls of the cedars, the best thing to do is to destroy these trees and shrubs in the vicinity of the orchard. The largest kind of cedar galls are associated with a rust of the apple.

The Quince Fruit Spot (*Entomosporium maculatum*, Lév.).—When the quinces approach their normal size, small brown spots appear, which soon enlarge, become confluent and turn to almost a black color. The decay is quite superficial and the ripe fruit thus spotted may be used, but the size is not what it would otherwise have been, and the price of the unsightly fruit is much reduced thereby.

This spotting is due to a fungus that, upon the pear, has been known for a long time as the one causing the cracking of the fruit, and on account of the peculiar

shape of the spores, shown in Fig. 139, has received the generic name of *Entomosporium*, or spore resembling an insect, while the last part of the botanical name, *maculatum*, means spot. In other words, the name when freely translated is as descriptive of the fungus as it well could be. The destruction which this fungus does to the quinces is second only to the ravages it works in the pear orchard, some varieties of the latter fruit failing unless saved, as they can be, by spraying. If it were

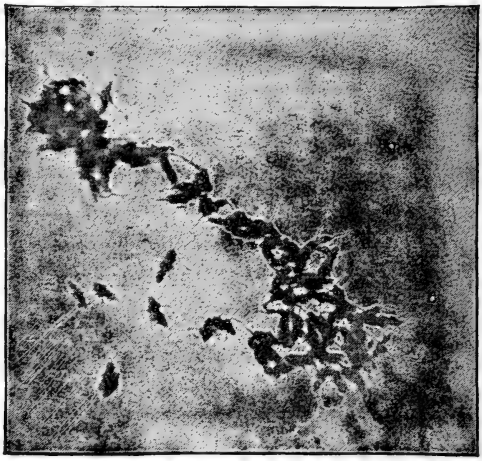


Fig. 139. SPORES OF QUINCE-SPOT FUNGUS.

confined to the fruit the damage might be less, but both quince and pear leaves suffer heavily. They become spotted and early fall away, leaving the branches bare, with their spotted and stunted fruit in full sight. It goes without further remark that the tree must hold its leaves green throughout the season to do the best work, and the fruit is dependent upon the foliage for its sustenance; therefore, anything that defoliates is injurious to the fruit, even if the latter in itself is not subject to attack from the same enemy. A view of a badly spotted

fruit of the quince is shown in Fig. 140. If, for example, worthless or neglected pear trees are standing near quince trees that are troubled with the spot, it may be that the former are the source of infection for the latter, and should be removed. The rule works in the opposite direction as well, and a hedgerow of starved

Fig. 140 BADLY SPOTTED QUINCE.

quince trees may be a menace to the choice sorts of pears growing near by.

Bad as the fruit spot may be, it can be controlled, in great measure, by thorough spraying, thanks to the prolonged tests of fungicides in this direction at several experiment stations.

THE BLACK ROT OF THE QUINCE (*Sphæropsis malorum*, Peck).—A common, and therefore destructive, decay of the quince appears upon the fruit when it is

less than half grown. Almost invariably the first signs of the rot are to be found at the blossom end of the quince, and from there it rapidly extends throughout the whole fruit. At first the skin, losing its normal green color, turns to a light brown, and shortly after this the dark pimples appear, scattered in the tissue close beneath the skin, which is ruptured when the spores are matured. The ripe spores are olive brown, about twice as long as broad, and form long, slender coils as they are pushed out of the small hole in the skin. They germinate quickly in water, and therefore render it easy to inoculate healthy fruit with the fungus. An infested quince of small size is shown in Fig. 141.

Fig. 141. QUINCE AFFECTED WITH BLACK ROT.

Some years ago the writer made a study of the *sphæropsis* of the apple and pear along with that of the quince, and as the spores are the same in size, the coloration alike in all, and inoculations easy from one kind of fruit to another, it is safe to conclude that the three are all the same.

A field observation in this connection bears directly upon the results above stated, and has a practical value that the orchardist will quickly appreciate. A large apple tree stands in an orchard surrounded on three sides by quince trees. The fruit, not of the best, is permitted to drop and accumulate upon the ground in midsummer, it being an early autumn sort. These fallen apples in 1890 were badly infested with the *sphæropsis*, as also frequently the fruit upon the tree. It was a

noticeable fact that the quince trees that were close to this tree, some of them almost under it, were the most severely attacked. While there was no actual transfer of the infection by artificial means to demonstrate the fact, the writer is quite willing to hold the opinion that the quince fruit received the germs of the decay from the apples that were rotting by the half bushel only a few feet away. That the decay should begin at the blossom end is not unexpected, for there the spores, and the water causing them to germinate, would naturally lodge. The growing filaments of the spores would there find an easier entrance than elsewhere, because of the adhering floral parts. Near by, and with branches interlocking, stands a pear tree, and the fruit was quite badly infested with the *sphæropsis*. Similar trees further away from the apple tree were less troubled with the decay, which only strengthens the opinion that all three kinds of fruit are naturally susceptible to the same infection, and the germs pass from one to the other through the air, or by means of the various insects that visit the fruits, especially those with broken surfaces, due to partial decay. The inoculations that were made in the laboratory seem confirmed by observations in the orchard. If the assumption holds, and it appears to be a sound one, it follows that the apple tree is a source of *sphæropsis* infection for the quince and the pear. The apple bears comparatively worthless fruit, and the quinces are the most valuable of all in this instance. There are several courses to pursue, the best of which cannot be foretold. If spraying is to be employed, it should be upon all three kinds of trees—apple, pear and quince. If the axe is to be used, it should be laid at the root of the apple tree. But if the apple tree is to be saved, the fruit fallen from it should be removed and destroyed. This, with faithful spraying, to be treated of later, should save both the pears and the quinces.

THE QUINCE PALE ROT (*Phoma Cydonia*, Sacc.).(?)—Next to the black rot the most prevalent decay of the quince is the one that may be well called the pale rot. This is a more rapidly growing fungus than the *sphæropsis*, and may run through a large quince in a few days. It begins at any place upon the fruit, producing at first a pale spot, from which the skin may easily be removed. The threads of the fungus soften the flesh of

Fig. 142. PALE ROT OF QUINCES.

the quince more than those of the black rot, and the skin soon wrinkles, and at the same time is ruptured in many places, from which short tufts of threads develop. These small spots, usually circular in outline, are at first colorless, but soon turn to a handsome shade of pale blue. A fruit with these numerous spots, or broad-faced pimples, is shown in Fig. 142. As the days pass, there is a spore cavity formed below the surface of each spot, and from this the spores finally issue in a thread

of slime through the ruptured center of the spot.

There has been a fungus found in Europe upon the quince, which, from its description, may be the one here under consideration. It was not met with upon the stems associated with the rot in question, and as access is not easy to the European specimens, the name for the stem form is here given tentatively. If it is upon the foliage in this country, it may follow that it passes from the leaves to the fruit, and this view of the

Fig. 143. QUINCE AFFECTED WITH RIPE ROT.

subject suggests that leaf treatment might be as advantageous for the pale rot as for the fruit spot and the black rot. In treating for one the remedy would be applied for all. This is an encouraging fact connected with spraying for these fungous enemies.

THE RIPE ROT OF QUINCES (*Glœosporium fructigenum*, Berk.).—There is a decay of apples which is quite destructive, causing brown depressions in the fruit, that become dotted over with pimples, producing multitudes of pinkish spores. It has been known as the Bit-

ter Rot, because of the disagreeable taste of the infected parts. Since it has been proved that the same fungus causes a decay of maturing grapes without the accompanying bitterness, the name of Ripe Rot has been applied to the fungus upon both kinds of fruit. That the same species thrive upon the quince is shown by the fact that the microscopic structure and measurement of parts are the same, and the decay can be produced in its normal form by inoculating the healthy quince with spores that are taken from the grape or apple ripe rot.

Fig. 144. RIPE ROT OF QUINCE, FROM APPLE.

A quince, with one side badly infested with the rot, is shown in Fig. 143. The quince being still green, there is little contrast between healthy and diseased portions; but the latter is evident from the shrunken condition, as well as the numerous spore-bearing pimples to be seen. A specimen of ripe quince fruit showing the same trouble, but produced by inoculation from the apple, is

seen in Fig. 144. This decay is controlled by the fungicides to be later considered.

THE QUINCE BLOTCH.—The most obscure trouble of the quince that has been studied is what may be called the Quince Blotch. There is no decay, in the ordinary sense, connected with it, but the fruit when only partly grown becomes blotched with black. This retards the growth of the immediate portion of the fruit, and soon the quince shows irregular depressions corresponding with the areas covered by the dark development.

A fungus is constantly associated with this blotching, and by isolation it was found to grow upon a colorless jelly called agar, and produce spots that correspond in outline with those upon the quince. The pure virus of the blotch, removed from the culture tubes and introduced into holes and cuts in healthy fruit, will produce the first indications of the blotching, but in a few days some other germs find entrance and the experiment must close.

OTHER DECAYS OF QUINCES.

The fungi that have been briefly described do not include all that produce a decay and destruction of the fruit, especially after it has been gathered from the trees. The most rapid decay of all is due to the presence of the black mould that causes the Soft Rot of the sweet potatoes, namely, *Rhizopus nigricans*, Ehrb. This mould does not seem able to attack the quince directly, but gets a foothold through any bruised, cut or otherwise mutilated surface of the fruit. Some other fungus, which in itself is neither deep-seated nor, therefore, serious, may prepare the way for the mould, and thereby be of much indirect damage. Fruit, for example, that may have only a few small patches of the *entomosporium*, or quince spot, is sometimes ruined by the *rhizopus* starting at the affected place and running

quickly throughout the whole fruit, when the quince almost melts down and becomes black with the profusion of spores upon the surface.

The gray mould (*Monilia fructigena*, Pers.) is another enemy similar in habit to the black mould. This fungus is one of the most serious to plums and cherries, causing their decay in a few hours. While quinces are not exempt, they, like the apples and pears,

Fig. 145. QUINCE SHOWY WITH DECAYS.

may be attacked if the fruit is packed while wet and left without ventilation.

There is a black rot, strictly so-called, which is occasionally met with in quinces. The fruit becomes almost the color of coal. There is a fungus associated with this, a member of a genus not usually accused of parasitic habits. It is a Pestalozzia, and does not seem to be recorded for this fruit. It has not been cultivated, and may prove to be the same as is found upon other

similar substances. In Fig. 145 is shown a quince with striking forms of decay.

In this connection one cannot dismiss, without a word, the thought that when fruits are nearing maturity they are approaching also that condition when vitality is at a low ebb, the seeds within the flesh being the only portions abounding with life. It therefore follows that fruits may be subject to both fungi that prey upon living tissue and those which are satisfied with the non-living organic substances.

The importance of keeping the natural barrier against this latter class, in all its strength, cannot be easily overestimated; in other words, the skin, if preserved unbroken, will shut out the larger portion of the fruit enemies of a fungous nature. Fungi that work upon the skin and go no deeper may be among the most destructive kinds, because they provide an easy entrance for forms of moulds that otherwise would be excluded.

TREATMENT.

In view of the fact that the quince fruit is subject to many enemies, some making a vigorous attack, as the rust in early summer, and others, as the fruit spot and the black rot, soon arriving, while later on several species make havoc, it follows that any treatment, to be most effective in preventing the destruction, must begin early in the season.

The two compounds that merit full commendation here for their effectiveness in checking the ravages of fungi in the orchard are the Bordeaux mixture and cupram (ammoniacal solution of copper carbonate). The following are the formulæ for preparing these fungicides:

(1) The Bordeaux mixture—

Sulphate of copper,	6 pounds
Quicklime,	4 pounds
Water,	22 gallons

Dissolve the copper sulphate in one gallon of hot water, and in another vessel slake the lime with a gallon of water; add the milk of lime slowly to the copper solution, stirring constantly, and strain through a sieve or coarse gunny sack; finally, add twenty gallons of water, and the mixture is ready to be applied with a spraying pump.

Good results are obtained with a mixture of half the above strength, which consists in doubling the water, or correspondingly diminishing the copper and lime. In like manner a one-third strength is often recommended, especially for the last sprayings.

(2) Cupram (the ammoniacal solution of copper carbonate) consists of—

Carbonate of copper,	5 ounces
Ammonia water (strength 4 F.),	3 quarts
Water,	50 gallons

Wet up the copper carbonate in a quart of water, add it to the ammonia, and when completely dissolved dilute with water, as needed.

It is well to use the Bordeaux (1) for the first half of the season, beginning as soon as the leaf buds open, and spraying the trees at least once each week. During the second half of the season, continuing until September, the cupram (2) may be used.

There are so many destructive fungi common to all fruit trees, that it is wise to spray all trees of the orchard, whether apple, pear or quince. If fruit falls badly it should be gathered and destroyed. Let no rot get a foothold anywhere.

For the preparation of this chapter the author has drawn largely upon a bulletin* he published a few years ago. Some of the cuts have been reproduced here.

*"Some Fungous Diseases of the Quince Fruit," Bulletin No. 91, New Jersey Experiment Station.

CHAPTER XXII.

VARIETIES OF RECENT INTRODUCTION.

BOURGEAT is a late importation from France, of thrifty growth, and thick, glossy leaves of a deep green. The fruit is pyriform, of good size, smooth, a bright yellow, of excellent quality, and keeps well.

VARIATIONS OF THE JAPANESE QUINCE.—The flowers of seedlings exhibit a variety of colors and shadings, from blood red to almost white. There is also a variation in the shape of leaves and fruit. By years of careful selection in the propagation, Wm. Parry has secured fruit of large size, of a greenish yellow, with a handsome blush, the surface ribbed like a citron, and covered with small white dots. He has named it "Columbia."

Luther Burbank of California, has produced, among his "new creations in trees, fruits and flowers," a dwarf tree from seed of an improved Japanese quince, which "is the shape of the Belleflower apple, but larger than the largest, and as smooth and as fine shaped as could be desired." We will name it for him the "Belleflower."

JOHNSON, produced by W. B. K. Johnson of Allentown, Pa., is a large, round quince, compressed at the stem, with a moderately angular surface, downy in the depressions. The color is greenish-yellow, marked with small dots. The flesh is yellowish, comparatively tender, with a mild aroma; quality good; ripens ten days later than the Orange, which it very closely resembles.

SANTA ROSA is a very large, fine-flavored quince, highly colored and strongly flavored. It cooks very tender, and can be eaten raw like an apple. The tree is somewhat straggling, but a strong grower. The fruit is smooth, and free from fuzziness. Mr. Burbank has named it in honor of the place of its origin.

VAN DEMAN, so named in honor of Prof. H. E. Van Deman, the former Pomologist of the Department of Agriculture, who says, "This variety is one of the very best, in every respect, I have ever examined, and the tree is reported as exceedingly thrifty and productive." Mr. Burbank writes me that "in California it often bears three distinct crops, about a month apart, and sometimes four; the last of the fourth is generally taken by frost." The fruit is large, oval truncate, greenish-yellow, flesh yellow, mild sub-acid, and of excellent quality.

QUINCE No. 80 is a seedling of Rea's Mammoth. The tree is like it in growth and productiveness. The fruit is a deep orange color, and the flesh lemon-yellow. It is nearly round, over thirteen inches in circumference either way, with the stem inserted in a cup half an inch deep, the basin of the calyx over an inch deep, and about two inches wide.

CALIFORNIA is a seedling of Rea's Mammoth. The trees grow upright, and fruit quite young. The fruit is pale lemon-yellow, tender, and of high flavor, free from fuzz.

CHAPTER XXIII.

CHEMICAL ANALYSIS OF THE ASH OF THE QUINCE.

DEAR SIR:

After a long delay I am able to send you a complete analysis of the ash of the quince fruits and wood which you sent for examination. I fear that the chemical analysis does not indicate very clearly anything of value in regard to the nature of the diseases to which the quince trees and fruits are subjected.

QUINCE FRUIT.

SPHÆROPSIS CYDONIA ROT.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+SiO_2 FREE.
Silicic Oxide,	*14.87	*14.87	*14.87	20.32	
Phosphoric Oxide,	4.40	4.46	4.43	6.05	7.59
Ferric Oxide,	0.42	0.42	0.42	0.57	0.72
Aluminic Oxide,	0.12	0.12	0.12	0.16	0.21
Calcic Oxide,	4.58	4.58	4.58	6.26	7.85
Magnesic Oxide,	5.10	5.13	5.11	6.99	8.77
Potassic Oxide,	†41.02	†41.02	†41.02	56.06	70.36
Sodic Oxide,	†1.94	†1.94	†1.94	2.65	3.32
Sulphuric Oxide,	0.53	0.85	0.69	0.94	1.18
Carbonic Oxide,	25.20	24.90	25.05		
Carbon (unburnt)	*2.30	*2.30	*2.30		
Sulphur (sulphide),	trace	trace	trace	trace	trace
Chlorin,	"	"	"	"	"
Total,	100.48	100.57	100.52	100.00	100.00

*One analysis; †mean of 3 analyses.

PARTIALLY DECAYED (natural).

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+SiO_2 FREE.
SiO_2	*9.19	*9.19	*9.19	11.72	
P_2O_5	9.59	9.59	9.59	12.23	13.85
Fe_2O_3	0.42	0.63	0.52	0.66	0.75
Al_2O_3	0.08	0.11	0.10	0.12	0.14
CaO	5.54	5.50	5.52	7.03	7.97
MgO	5.90	5.80	5.86	7.47	8.47
K_2O	†45.14	†45.14	†45.14	57.60	65.23
Na_2O	†1.64	†1.64	†1.64	2.09	2.37
SO_3	0.91	0.79	0.85	1.08	1.22
CO_2	‡18.71	‡18.71	‡18.71		
C	*2.79	*2.79	*2.79		
S	trace	trace	trace	trace	trace
Cl	"	"	"	"	"
Total,	99.92	99.89	99.90	100.00	100.00

*One analysis; †mean of 3 analyses; ‡mean of 4 analyses.

TWIGS OF THE QUINCE TREE.

HEALTHY.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+ $Si\,O_2$ FREE.
Silicic Oxide,	*2.49	*2.49	*2.49	3.72	
Phosphoric Oxide,	3.54	3.64	3.59	5.36	5.57
Ferric Oxide,	0.15	0.15	0.15	0.22	0.23
Aluminic Oxide,	0.13	0.09	0.11	0.16	0.17
Calcic Oxide,	37.06	37.08	37.07	55.38	57.51
Magnesic Oxide,	4.10	4.10	4.10	6.12	6.36
Potassic Oxide,	†17.27	†17.27	†17.27	25.80	26.79
Sodic Oxide,	†1.69	†1.69	†1.69	2.52	2.62
Sulphuric Oxide,	0.68	0.29	0.49	0.72	0.75
Carbonic Oxide,	‡31.63	‡31.63	‡31.63		
Carbon (unburnt),	*1.19	*1.19	*1.19		
Sulphur (sulphide),	trace	trace	trace	trace	trace
Chlorin,	"	"	"	"	"
Total,	99.93	99.62	99.77	100.00	100.00

*One analysis; †mean of 4 analyses; ‡mean of 3 analyses.

KILLED BY FUNGUS RŒSTELIE AURANTIACA.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+ $Si\,O_2$ FREE.
$Si\,O_2$	*3.76	*3.76	*3.76	4.89	
$P_2\,O_5$	6.90	7.04	6.97	9.06	9.53
$Fe_2\,O_3$	0.15	0.15	0.15	0.19	.21
$Al_2\,O_3$	0.35	0.29	0.32	0.42	.44
$Ca\,O$	13.00	13.00	13.00	16.91	17.77
$Mg\,O$	6.15	6.01	6.07	7.89	8.30
$K_2\,O$	†42.43	†42.43	†42.43	55.18	58.01
$Na_2\,O$	†3.63	†3.63	†3.63	4.72	4.96
$S\,O_3$	0.49	0.65	0.57	0.74	0.78
$C\,O_2$	21.00	20.84	20.92		
C	*1.77	*1.77	*1.77		
S	trace	trace	trace	trace	trace
Cl	"	"	"	"	"
Total,	99.63	99.56	99.59	100.00	100.00

*One analysis; †mean of 4 analyses.

ROOTS OF THE QUINCE TREE.

HEALTHY.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+SiO_2 FREE.
SiO_2	*7.93	*7.93	*7.93	10.76	
P_2O_5	1.67	1.61	1.64	2.22	2.49
Fe_2O_3	0.84	0.84	0.84	1.14	1.28
Al_2O_3	0.38	0.48	0.43	0.58	0.66
CaO	36.18	36.36	36.27	49.20	55.13
MgO	3.05	3.11	3.08	4.18	4.63
K_2O	†19.83	†19.83	†19.83	26.89	30.13
Na_2O	†1.70	†1.70	†1.70	2.31	2.58
SO_3	2.09	1.92	2.00	2.72	3.05
CO_2	25.25	25.17	25.21		
C	*0.57	*0.57	*0.57		
S	trace	trace	trace	trace	trace
Cl	"	"	"	"	"
Total,	99.49	99.52	99.51	100.00	100.00

*One analysis; †mean of 4 analyses.

KILLED BY BORERS.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+SiO_2 FREE.
SiO_2	*16.52	*16.52	*16.52	20.46	
P_2O_5	2.28	2.27	2.28	2.82	3.55
Fe_2O_3	0.78	1.10	0.94	1.16	1.46
Al_2O_3	1.18	1.00	1.09	1.35	1.70
CaO	41.38	41.38	41.38	51.24	64.43
MgO	3.89	3.97	3.93	4.87	6.12
K_2O	11.47	11.46	11.46	14.20	17.84
Na_2O	1.76	1.76	1.76	2.18	2.74
SO_3	1.45	1.34	1.39	1.72	2.16
CO_2	†18.30	†18.30	†18.30		
C	*0.63	*0.63	*0.63		
S	trace	trace	trace	trace	trace
Cl	"	"	"	"	"
Total,	99.63	99.73	99.68	100.00	100.00

*One analysis; †mean of 3 analyses.

WOOD OF THE QUINCE TREE.

KILLED BY BORERS.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+ SiO_2 FREE.
SiO_2	6.24	6.34	6.29	9.06	
P_2O_5	2.92	2.78	2.85	4.10	4.51
Fe_2O_3	0.78	0.78	0.78	1.12	1.23
Al_2O_3	0.50	0.50	0.50	0.72	0.79
Ca O	41.74	41.66	41.70	60.05	66.03
Mg O	4.92	4.85	4.88	7.03	7.73
K_2O	10.49	10.42	10.45	15.05	16.56
Na_2O	1.75	1.75	1.75	2.52	2.77
SO_3	0.24	0.24	0.24	0.35	0.38
CO_2	*30.38	*30.38	*30.38		
C	0.44	0.47	0.46		
S	trace	trace	trace	trace	trace
Cl	"	"	"	"	"
Total,	100.40	100.17	100.28	100.00	100.00

*Mean of 4 analyses.

KILLED BY BLIGHT.

CONSTITUENTS DETERMINED.	A	B	MEAN.	CO_2+C FREE.	CO_2+C+ SiO_2 FREE.
SiO_2	*3.80	*3.80	*3.80	4.86	
P_2O_5	4.31	4.30	4.31	5.51	5.80
Fe_2O_3	0.42	0.42	0.42	0.54	0.56
Al_2O_3	0.14	0.08	0.11	0.14	0.15
Ca O	45.18	45.18	45.18	57.81	60.77
Mg O	4.67	4.63	4.65	5.95	6.25
K_2O	†18.20	†18.20	†18.20	23.29	24.48
Na_2O	†0.27	†0.27	†0.27	0.35	0.36
SO_3	1.32	1.11	1.21	1.55	1.63
CO_2	21.35	21.43	21.39		
C	*0.40	*0.40	*0.40		
S	trace	trace	trace	trace	trace
Cl	"	"	"	"	"
Total,	100.06	99.82	99.94	100.00	100.00

*One analysis; † mean of 3 analyses.

They were all made in duplicate, except when indicated otherwise, and the results of each duplicate analysis are entered under columns A and B of each subhead. Following this is a column headed "Mean," showing the mean content of each particular substance as indicated by the single or duplicate analyses. For the purpose of more direct comparison the component parts of the several samples have been calculated to material free of carbonic acid and unburned carbon, and these results are given under the column marked CO_2+C free. Since, in the case of the root, it was almost impossible to exclude the sand, which was present as an impurity, the data have also been calculated to substance free of silica and carbonic acid and unburned carbon. These data are contained in the column marked $CO_2+C+SiO_2$ free. This explanation will enable you to understand sufficiently well the tabulation of the results.

As you will notice by the table, comparisons are made directly between the same parts, as nearly as possible. For instance, the quince fruit affected by rot is compared directly with the quince fruit of a healthy nature, although partially decayed from natural causes. In the same way the ash of the roots of the healthy tree is compared with the ash of the roots of the tree killed by borers, and in a like manner the ash of the twigs of the healthy tree is compared directly with the ash of the twigs of the tree killed by the fungus. The ash of the tree killed by borers is compared also directly with the ash of the tree killed by blight. The above, I hope, will be a sufficient description of the tables to enable you to understand them thoroughly.

In regard to the lessons which these per cents teach, a few conclusions may be drawn from a study of the analytical results. The diseased quince fruit is decidedly richer in silica than that of the healthy fruit, while, on the other hand, the healthy fruit contains a large

excess of phosphoric acid over that of the diseased fruit. The healthy fruit also contains a decidedly smaller portion of potassium. All comparisons of lime, potash and phosphoric acid which follow, are based on ash free of silica, carbonic acid and unburned carbon.

The conclusions derived from these data are: that the rot prevents the fruit of the quince from absorbing its normal portion of phosphoric acid and tends to increase the potassium, and indicates that a liberal fertilization with phosphoric acid might stimulate the tree in some way to withstand the ravages of the rot.

In respect of the roots of the healthy and diseased trees, it is interesting to note that the healthy trees contain far less silica in the roots than those of the trees killed by the borers; the proportion being less than one-half. This may be explained by the fact that the soil may work its way into the holes made by the borers. The roots of the healthy trees also contain very much larger quantities of potassium than those of the injured trees; while, on the other hand, the proportion of phosphoric acid present in the ash of the healthy roots is decidedly less than that in the ash of the injured roots. The injured roots also have a larger quantity of lime.

In regard to the twigs, there is a most striking difference between the ash of the healthy twigs and of the twigs killed by the fungus. This difference is found in the practical exchange of the per cents of potash and lime. In the healthy twigs the lime is in large excess over the potash, while in the diseased twigs the potash is in very large excess over the lime. This is a most remarkable fact and shows the effect which the disease has upon the normal absorbing power of the twigs themselves.

In regard to the ash of the wood from the trees killed by borers and blight, it is found that the potash in the wood killed by blight is in excess of the same constitu-

ent in the wood killed by borers, while the reverse is true of the lime. In general, it seems that a diseased tree tends to accumulate in its ash a larger percentage of potash, both in the wood and fruit, than would be normally present in a healthy tree; in the roots, however, the reverse appears to be true. There may be some exceptions to this rule, but the tendency is as indicated.

Hoping that this information may prove of some use to you, I am, Respectfully,

H. W. WILEY, *Chemist.*

U. S. DEPARTMENT OF AGRICULTURE.

To REV. W. W. MEECH, Vineland, N. J.

CHAPTER XXIV.

BIRDS—TOADS—RABBITS—MICE.

BIRDS.—Much might be said of the value of poultry in the orchard to destroy insect enemies. Insectivorous birds are also valuable allies for the horticulturist; but in merit our domestic fowls outrank them all. It is advantageous to raise fruit and fowls together. It will be to the advantage of both if the fowls are in number proportionate to their field of operation.

Poultry are supposed to omit from their bill of fare some of our insect friends, and it is probable the birds do likewise; but all insects are devoured by the toad, which will clear your room of cockroaches over night, just as he will your gardens of the vilest of your insect foes. I find a movable fence, in sections that can be put together whenever it is wanted, a very convenient thing for poultry. It may be made of lath nailed on scantling. Others are using netting of wire cloth, and find it satisfactory. It is to be hoped that the laws protecting insectivorous birds will be generally respected, and that our song birds will be left to multiply in our orchards and gardens. The English sparrow is an enemy to be destroyed, for doing more harm than good.

RODENTS.—There are two rodents that deserve notice as enemies of the quince, apple, and pear.

1. THE HARE or GRAY RABBIT (*Lepus sylvaticus*).—The hare, or rabbit, as it is commonly called, injures young trees by cutting off the tops and by gnawing the bark from those too large to eat off. This is often a very serious damage in both the nursery and the orchard. They multiply rapidly, and sometimes become formidable.

Remedies.—They are easily caught in traps and snares. They may also be poisoned by strychnine, a small portion being placed on pieces of carrot, of which they are very

fond. The bark may be protected by smearing it with blood, or rubbing it with liver, or smearing it with tobacco water, or lime water, with enough copperas added to turn it green. A little cheap glue will make the wash stick to the bark. Thick paper around a tree will keep them from gnawing the bark. Charles Downing recommends a paint made of a handful of flowers of sulphur, half a spadeful of soot, a spadeful of fresh cow dung, with a spadeful of hot slacked lime, applied on a dry day. He says English gardeners set up swabs dipped in melted sulphur among the trees in their nurseries.

2. Meadow Mice (*Mus arvicolæ*).—Meadow mice are

Fig. 146. Fig. 147. Fig. 148.

SAVING GIRDLED TREES.

known by various names in different parts of the country, such as short-tailed field mice, ground mice, etc., and are sometimes called moles, although they are very different from them. They are covered with long gray hair, have very thick heads, and very short tails. They all burrow in the ground. The greatest damage done by meadow mice is gnawing off the bark of fruit trees. They do this most when the ground is covered with snow. Like the rabbit, they multiply rapidly. Their hiding places may be found in brush heaps, under stacks of grain and hay, and similar places.

Remedies.—Burn the brush heaps. Set the rails up on end so as not to make a shelter for the mice, and keep

cats or a dog to hunt them. Hawks catch them by day and owls by night. Skunks, foxes, etc., also help to lessen their numbers. But, after all, they will multiply rapidly if grass and weeds are left in the orchard. The rabbit remedies will also answer for mice.

Girdled trees may sometimes be saved, if the injury is discovered before the wounds get dry, by banking the tree with moist earth. A more certain way is by inserting a row of cions around the girdled place, either by halving them and inserting the ends under the bark above and below, or by using strips of bark for the same purpose. The edges of the bark should be cut smooth and even to insure success. In either case they should be well protected by grafting wax.

CHAPTER XXV.

MEDICINAL AND ECONOMIC USES OF THE QUINCE.

EVERY part of the quince is useful. Its scarcity and consequent high price have kept it in the good housekeeper's list of luxuries. But when its cultivation becomes more general, it will come within the reach of all, and be in still greater demand.

In the first century of the Christian era the old Roman Columella said: "Quinces not only yield pleasure, but health." A modern writer of note says: "Medicinally, the quince is cooling and strengthening. The juice is good against nausea. The ripe fruit eaten raw is said to be good for spitting of blood; also for swollen spleen, dropsy, and difficult breathing."

"The quince in the Materia Medica," according to Lewis and Woodville, "is astringent and stomachic. The juice in nausea is to be given in doses of a spoonful or two; so in vomitings, inodorous eructations, and some kinds of alvine fluxes. In the London Pharmacy this juice

was formerly ordered to be made into a syrup called Syrupus Cydonareun. or syrup of quinces; and was prepared by digesting three pints of the depurated juice with a drachm of cinnamon, half a drachm of ginger, with half a drachm of cloves, on warm ashes for six hours, and then adding a pint of red port and dissolving in the strained liquor nine pounds of sugar. But the only preparation of the quince it now directs is a mucilage of the seeds, made by boiling a drachm of these in eight ounces of water till it acquires a proper consistence. This has been recommended in apthous affections and excoriations of the mouth and fauces. It may be more pleasant, but less efficacious than that of the simple quince." In 1831 Henry Phillips reported the cure of a severe case of asthma at Horsham, in Sussex, England, by using quince wine.

1. QUINCE WINE is made of equal parts of quince juice and water, with three and a quarter pounds of sugar to the gallon, added before it is fermented. The seeds are taken out before the fruit is crushed or grated. If the water is omitted, the medicinal value will be greatly increased.

2. QUINCE SYRUP, made by boiling the richness out of the fruit, and dissolving, in the water used, sugar enough to give it a good heavy body, will be found delicious for the soda fountain. Without the soda it is a pleasant summer drink in water.

3. QUINCE WATER, made by pouring hot water over the dried fruit, and letting it steep awhile, is a good substitute for tamarind water. It is most acceptable to invalids desiring a cooling acid drink.

4. BANDOLINE is made by covering the seeds with forty to fifty times their bulk of warm water, which soon produces a mucilage used by perfumers and hair dressers. Many ladies prepare it for themselves to keep their hair in place. It can be perfumed with any kind of odor.

By the addition of a little alcohol it can be kept for a long time. It is this use of the seeds which causes the great demand with druggists.

5. QUINCE PRESERVES are made by first cooking the fruit soft, and then adding as many pounds of pure sugar as there were pounds of the raw fruit, and simply scalding it through thoroughly. The importance of not adding the sugar to acid fruits till after they are cooked soft has not been sufficiently understood. It is estimated to require double the sugar if it is put into the fruit at first; because the conversion of the cane sugar into glucose or grape sugar lessens its sweetening power very greatly; some say more than one-half.

The receipts in the cook books give directions for a long and tedious process to do what is so short and simple by this method. To prevent mould on jars of preserves or jellies, they should be kept in a cool place and covered closely from the air. A thin paper covering, wet with alcohol or lard, and gently pressed on the sweetmeat, is a safeguard; or cover with a thin film of lard without the paper. Melted paraffine poured over the confections serves the same purpose, and is very easily removed when they are used.

6. QUINCE MARMALADE is made by cooking the fruit soft, crushing to a pulp, and adding sugar to taste. Boil slowly, stirring constantly to prevent sticking or burning. When it falls off a spoon like jelly, it is done, and can be molded in cups and covered the same as jelly. One-third sweet apples may be added without more sugar, and still the flavor will be sufficient to suit many tastes.

7. QUINCE BUTTER is made much like the marmalade, except the addition of sugar. This is a favorite fruit confection in the Philadelphia market.

8. QUINCE COMPOTE.—Pare a dozen quinces, cut them in halves, and take out the cores. Put in a preserving vessel enough clear syrup to cover them, and add the

juice of two lemons. Heat the syrup, and add the quinces, boiling well together. Drain the fruit, and pack it in a compotier. Leave the syrup to thicken a little, and pour it over the quince.

9. QUINCE SAUCE is made by simply stewing the fruit soft, then mashing and adding sugar to taste. The addition of one half apples or pears will greatly increase the quantity and yet leave a good quince flavor.

10. QUINCES CANNED, or bottled as sauce, are as successfully put up as any other fruit for similar use, only remember to cook soft before adding the sugar, as, besides the sweetening, there will be a toughening of the fruit. I canned a large quantity in glass jars (the Lightning can preferred), first packing them full of the raw fruit, then filling with water, and boiling till soft in a common wash boiler on my cook stove. The safety of the jars was secured by a very thin skeleton frame of wood on the bottom of the boiler. After the fruit was soft, the jars were lifted out, and the water poured off, and half a pound of dissolved granulated sugar added for each quart jar. This made a rich, heavy syrup, which was returned to the fruit in the jar. Replacing the jars in the boiler, they were soon boiling again, when they were ready to seal. Lastly, they were inverted, and left so till cooled. By this last process it was easy to discover if the jar and sealing were perfect; if not, bubbles of air would press in and show at once on the surface.

11. BAKED QUINCES are a favorite with some. Wash and core, then fill with sugar, and bake in a dish or pan containing a little water, to eat hot or cold with cream and sugar. Or, having cut in halves, without paring or coring, boil till nearly tender, and then, covered with sugar, bake in a hot oven, basting often with the syrup made by the sugar and water in which they were boiled. When done put a lump of butter on each half. Turn the syrup over them, and serve as before.

12. Sweet Pickles.—Prepare as for preserves. Cook tender in water, drain well, and simmer for five minutes in a syrup of good vinegar, covering the fruit, and add sugar, one and a half pounds to a pound of quinces, with spices of cinnamon, allspice, mace, and cloves to suit one's taste. The water in which they were boiled can be used to make jelly. A pint of vinegar to seven pounds of fruit is a good proportion for sweet pickles to keep well.

13. Quince Jelly, when well made, is unsurpassed. Most housekeepers use the parings and cores of such as have been used for some other confection. It is better to leave out the cores, as the mucilage around the seeds may make the syrup ropy, and hinder success. The skin, with what adheres, contains the part of fruit richest in pectine, and so is best for jelly. Indifferent fruit should be cooked with the skins for jelly. Apples may be used to increase the quantity of jelly without seriously reducing the flavor. Cook the apples, and then the quinces in the same water. The color of all jellies may be kept light by shortening the time of boiling; and this may be done by dividing the fruit into three or four parts, cooking them successively in the same water. By the time the last is cooked, and the pulp pressed and syrup strained, the sugar can be added; by measure rather than weight, bulk for bulk. When the sugar is added to the syrup a scum will rise, and should be removed. No more skimming is necessary till it is done, when another skimming will leave it entirely clear. The exact jellying point in the process must be determined by trial as the boiling proceeds. *Longer boiling may reduce it to a syrup again.* As soon as the jelly is done, let the heat subside a little, and pour into cups to mold it for use; and in a few minutes after, run a spoon around the top of the cups to gather the film, when each will be perfectly smooth and glassy. Preserve from mould as above described for preserves.

INDEX.

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